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AMERICAN INDUSTRIES.—No. 67.

ASBESTOS

That American mechanics, inventors, and business men are pre-eminently practical is acknowledged the world over. They are always pronounced utilitarians—making the first count in their valuation of almost every new article answer to the questions: What is it worth to us to-day? How much can we save by its use? Will it meet our necessities better than what we have heretofore used? It is important that these and similar queries be answered in a plain and straightforward way, in regard to every new product whose manufacture is destined to take a permanent place in our industries. But what reply would such inquiries have elicited twenty years ago, supposing them to have been then made, as to the usefulness of asbestos, or anything made therefrom? The probability is that comparatively few people at that time even knew that there was such an article. A few students, however, might have furnished some very curious reports about it—how the ancients used to wrap the bodies of their dead in asbestos cloth to keep their ashes separate from those of the funeral pile; how Charlemagne had a tablecloth made thereof, and astonished his guests by throwing it into the fire after dinner, whereby it was cleaned without burning; how an Italian chevalier had a complete dress of asbestos, with which he made successful experiments in testing its protective qualities for firemen's uses; how numerous tricks in fire handling have been performed by its aid, etc.; but with all this there had been developed nothing of any considerable practical value, and the possibilities of future usefulness in this fine fibered, fire and acid proof mineral were, apparently, no better than they had been when the pyramids were built.

Asbestos (from a Greek word meaning inconsumable) is a variety of the hornblende group of minerals, and the chemical composition of the whole family is chiefly silica, magnesia, alumina, and ferrous oxide; but the qualities vary widely. In color it is usually from white to gray and green—sometimes yellow, when impregnated with iron—with fine, crystalline, flexible fibers of a silky luster, and feels somewhat oily to the touch, although in its native state it is as little suggestive of the uses for which it may be made available as the rough iron ore is of a chronometer. A few years ago it was supposed to be very rare, but since there has been a demand for it in considerable quantities new sources of supply have been opened up, and it is now found in many parts of Europe and America, the best quality coming from this country. The inquiry for asbestos for manufacturing purposes had, we believe, its commencement with the foundation of the industry which we illustrate in this paper with engravings of the manufacturing establishment of the H. W. Johns Manufacturing Company, which has grown out of the business established by Mr. Johns in 1858.

It was not until 1868 that Mr. Johns made known to the world his discovery of the practical value of this remarkable mineral, and the nature of his patented inventions. That he has labored intelligently in this comparatively new field is proven by a gratifying success and a world-wide reputation, for his asbestos products are in use wherever materials for structural and mechanical purposes are employed. Every year additional improvements and processes have been made by Mr. Johns, and, as the various branches of the industry became better known, it is not strange that he has had many imitators in his line of manufacture.

The main departments of the factory will be readily distinguished at a glance from our artist's representation. The

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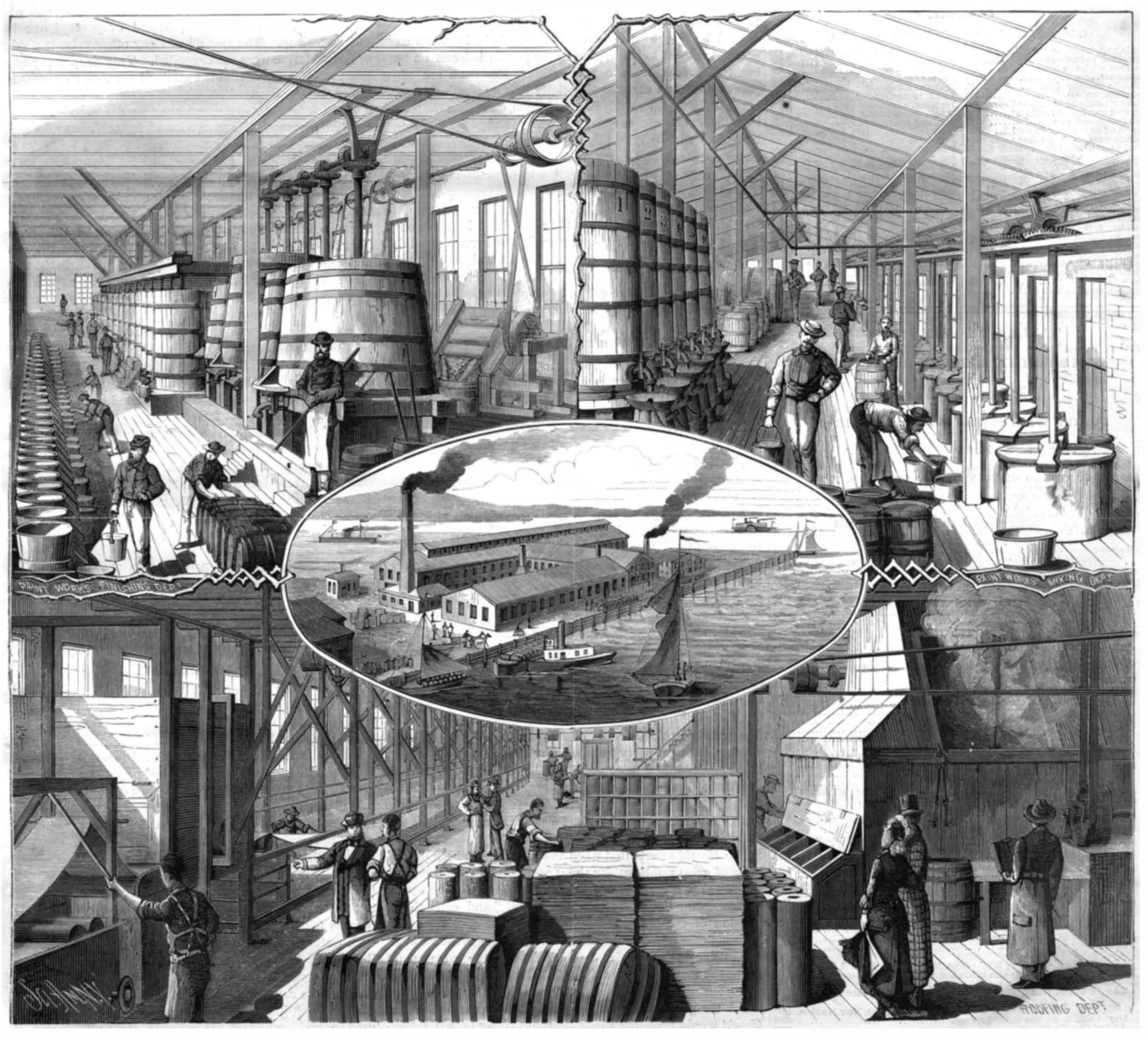

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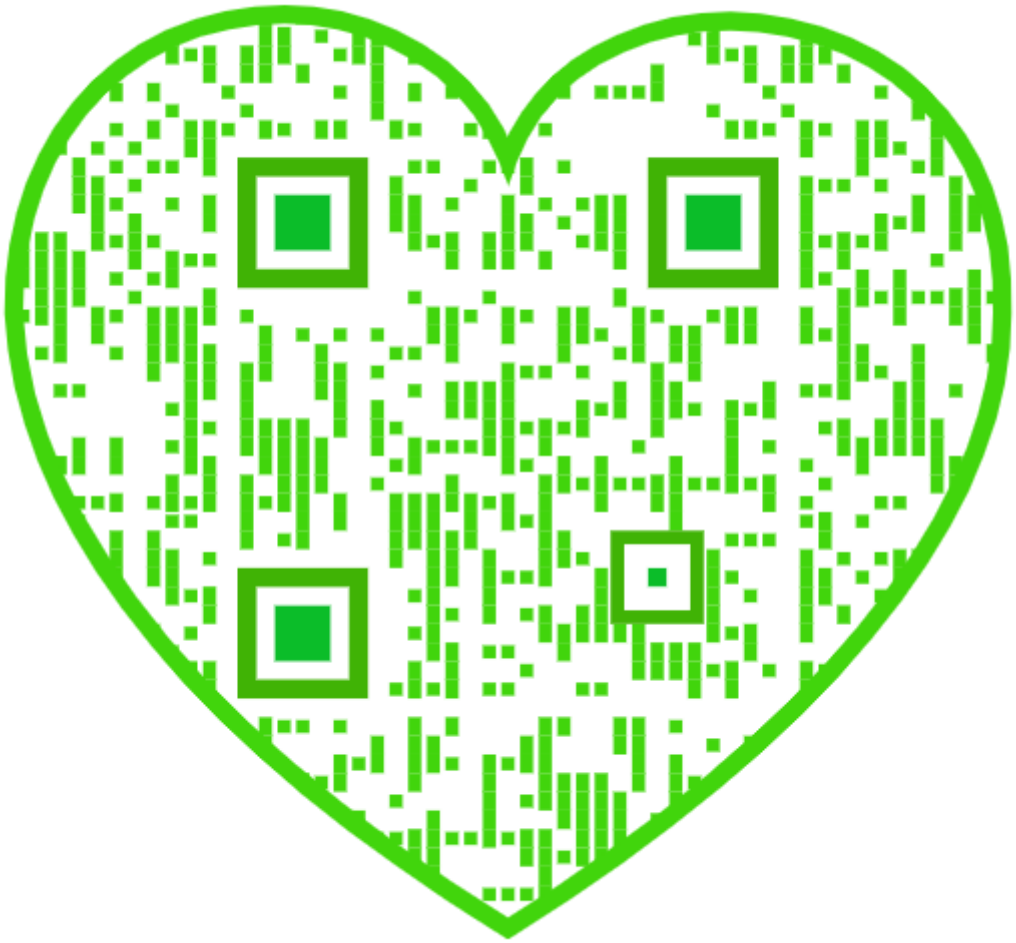

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THE ENCOURAGEMENT OF INVENTIONS—WITH A RESERVATION.

A curious phase of opinion crops out constantly in newspaper comments on patents and the rights of inventors. Even journals of metropolitan dignity and influence give frequent evidence of it, and thus unwittingly encourage the attacks upon the patent system of parties interested in the infringement of patent rights. The opinion referred to is hard to formulate, but it seems to be, in brief, that inventors ought always to be encouraged—provided they do not invent too much or do their work too well. In all secondary and relatively unimportant matters the inventor's rights should be strictly respected and rigorously guarded; but when the inventor produces some article or process of exceptional value, something that the public cannot afford to do without, after they have learned to use it, then it should promptly be taken away from him. Having control of something that everybody wants, the patentee becomes an "odious monopolist." His service to the public in producing so great a convenience is forgotten or grudgingly admitted. The direct or indirect advantage of the invention to the public may be a thousand dollars to every hundred dollars received by the inventor for its use; the thousand is accepted as a natural right and no account is made of it, while the inventor's hundred is eyed askance as so much paid for an intangible idea. It was such a simple thing! Scores of people must have thought of it if he had not; why, then, should people pay for what they might have had for nothing if they had only had the mind to think of it? No comparison is made between their condition before the invention was made and after it was adopted, but only between their condition with the invention and paying for it, and their condition having the invention and not paying for it. The visible thing is the inventor's profit, and that is grudged him.

A pretty illustration of this thankless logic is furnished in the editorial comments of the *Herald* on Judge Nixon's recent decision sustaining the right of the Bate Refrigerating Company to the processes covered by their patent.

The *Herald* says: "Our patent laws sometimes lead to practical absurdities. If there be but one safe and economical method of preserving fresh meats shipped to Europe, the vast dimensions and possibilities of this expanding trade make it for the general interest of commerce that this method should be free to all. It would be well if all patents were granted subject to revocation in the public interest on payment of a reasonable compensation. Processes are often patented of such extreme simplicity that hundreds of ingenious minds would readily discover them, and when the patent injuriously obstructs a great branch of foreign trade the public should not be compelled to await its expiration. The government which creates these artificial rights should grant them with an explicit reservation in favor of the public."

The absurdity of this position is simply grotesque. It assumes that the patent system is not designed "in favor of the public;" but that its purpose is to reward the inventor only. The truth is the patent system regards the inventor and his encouragement simply as a means to an end, and that end is the advancement of the useful arts and sciences for the public benefit. The proposed reservation would simply defeat the end aimed at by attaching a penalty to successful invention.

The alleged obstructiveness of the more perfect inventions when patented is equally absurd. Admit, for the sake of argument, the assumption that there is but one safe and economical method of shipping fresh meat to Europe. Without the inducements held out by the Patent Office that method would not have been developed, perfected, and patented. Knowing that a successful solution of the problem would be profitable to them, the inventor and his associates thought, studied, and experimented until the solution was gained, and then accepted the terms offered by the government for the temporary monopoly of their system. Without the invention there could be, it is assumed, no profitable shipment of fresh meat to Europe. With it such shipment is possible. So far there has been an extension, not an obstruction of trade. Other men are at liberty to perfect, if they can, the previously existing methods or to devise new methods. They plead that they cannot; therefore, they say, our inventor must let them use his method for nothing, or for a price which they think is reasonable. If he will not consent he is an obstructor of trade!

To revoke the "obstructive" patent because its value has led other men to covet the privilege it covers would be a breach of contract on the part of the public that would react disastrously in the discouragement of further invention. To confiscate the property indirectly by compelling the owner to surrender it at a price not fixed or agreed to by himself would be equally impolitic and scarcely less unjust. We doubt whether there was ever an invention which the inventor would not part with for a "reasonable compensation."

The *Herald* asserts that when an invention has been proved to be of great public utility the "government should possess the power to open it to universal use without waiting seventeen years for the expiration of a patent," and calls this a revision of the patent laws "in the interest of justice and common sense." If a patentee, realizing the great value of advertising in the *Herald*, should insist that the government ought to compel the *Herald* to advertise his patented invention "for the public benefit" for nothing, or at a price which the patentee or his friends might fix as reasonable, the *Herald* would probably speak disrespectfully of his intelligence.

IS GLUCOSE UNWHOLESOME?

The manufacture of glucose and starch sugar having increased with surprising rapidity recently we are frequently asked whether its use will injure the health. Some claim that it will, others assert the contrary. Reliable experiments by competent persons are rare, and every fact which throws any light upon the subject is welcome and will have its effect. We are, therefore, willing to give place to certain statements made by Dr. J. Nessler, of Baden, in regard to his own experience with starch sugar. In Germany the starch is made from potatoes, and of course German glucose may possess some properties unlike ours, which is made from corn-starch. The specimen used by Dr. Nessler in his experiments may or may not have been a fair average of the glucose made in that country, but his statements will suggest to courageous parties at home the propriety of putting American glucose to the same tests or similar ones.

This kind of sugar has been used for nearly fifty years, says Dr. Nessler, for improving sour wine, in making beer, and in confectionery. Since starch is not injurious to the health, and the sulphuric acid is almost completely removed, it was assumed that no hurtful substance could be formed by the action of dilute acid on starch. Up to a very recent period no one harbored a suspicion that starch sugar could exert any injurious effect. This kind of sugar is cheaper and is better fitted, for other reasons too, for making cheap drinks than cane or beet sugar. It had, therefore, been recommended officially and privately, even by Dr. Nessler himself, under the conviction that the use of brandy could best be checked by the manufacture of good and cheap drinks.

Not long since A. Schmitz, who drank natural wine one day and wine containing glucose the next day, tried the experiment of injecting the unfermentable substance contained in starch sugar into the veins of a dog. He noticed that starch sugar had, or might have, a stupefying or narcotic effect.

Incited by these statements of Schmitz, Dr. Nessler began some experiments with the unfermentable constituents of such sugar. He obtained from Alsace a 20 per cent solution of a sugar which was free from arsenic and in which there was 26 per cent of unfermentable substances. To the solution he added enough yeast to set up fermentation, and when this was added, filtered the liquid and evaporated one liter of it to a sirup. The alcohol and any other volatile product of fermentation were thus expelled. This sirup was now diluted to 100 c.c., so that it contained ten times as much of the various unchanged constituents as the original solution. At 7 A.M. he took 50 c.c. (nearly 2 fluid ounces), representing 100 grammes of sugar, and at 10 A.M. as much more. Its taste was bitter and repulsive. Toward noon he felt rather badly, but not sufficiently to be able to ascribe with certainty any hurtful action to the extract which he had taken. At 2 P.M. he took as much of the residue as represented 100 grammes of sugar, but this time it had not been evaporated so far as the first time, but only to two-fifths. An hour later a violent perspiration broke out, and a little later a violent headache set in which lasted until late in the night.

A few days later Dr. Barth, assistant at the experimental station, took the unfermented portion from 90 grammes (over 3 ounces) of the starch-sugar at 10 A.M. The fermented and filtered liquid was again evaporated to three-fifths. A cold perspiration soon showed itself, attended with a tightness of the chest. At noon he had no appetite, and threw up the soup which he had eaten. In the afternoon he was seized with a violent headache that lasted until evening, and the next day he did not feel well.

Dr. Nessler thinks there can be no doubt left a substance injurious to health remains in the liquors made by fermenting this sugar. Possibly not all starch-sugar has the same effect, but there is always a bitter substance or extract left after fermenting and evaporating, which turns the plane of polarization to the right. It is probable that all are more or less injurious according as it contains more or less of this substance.

Whether this substance is formed during the fermentation or was already there, and whether its injurious effects are not destroyed or neutralized by the alcohol in which it is usually dissolved, are questions which he does not attempt to answer.

WRITING INK.

There are few chemical preparations the use of which has become so general as that of writing ink. And yet it is rare to find an ink that fulfills all the conditions required of it. This is explainable upon the ground that ink recipes are not constructed according to any chemical formula, but that we are compelled to rely upon empirical experiments and make use of the results gathered by practical experience. A good black ink must flow easily from the pen, and must yield either immediately or in a short time a deep black writing. It must not corrode metallic pens nor destroy the paper. Further than this, a good ink should contain no considerable sediment when kept in airtight bottles. In ordinary ink bottles a sediment will always form, and the more it is exposed to the atmosphere the faster it will form. An ink that is to be used for important documents must not be washed out with water or absolute alcohol so as to be permanently illegible.

Ink may consist of either a clear solution of any dyestuff, or, as in the case of common black ink, a finely divided, insoluble precipitate suspended in water. The chief materials used for making this ink are gallnuts, green vitriol, and gum, which are employed in the most varied proportions. The

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gallnuts are crushed to a coarse powder and boiled in water, or better, digested for several hours at a temperature near the boiling point, and the gum and green vitriol added to the filtered decoction in solution.

The following example will serve as ink for ordinary use: 12 parts galls, 5 parts green vitriol, 5 parts gum senegal, and 120 parts water.

An exceedingly fine ink is said to be produced by the following recipe: 11 parts galls, 2 parts green vitriol, one-seventh part indigo solution, and 33 parts of water. Here the relatively larger quantity makes the gum unnecessary, while the indigo solution makes the brilliant black seem still deeper. Writing executed with this ink may, it is true, be removed by means of dilute acids, but it may be rendered visible again by chemical means.

There is also an ink in the market in which the galls are replaced by logwood; but the writing is less black and can be totally destroyed by treatment with acids and cannot be restored by other means.

The so-called alizarin inks flow easily from the pen, but they mostly suffer from the fact that the writing appears at first only of a faint greenish, bluish, or reddish color, although it gets darker afterward.

The most permanent writing is done with India ink, because the black coloring matter of this ink consists of finely divided carbon, which is unaffected by chemical reagents. Its high price seldom permits of its use.

For ordinary use only such ink is recommended as consists either of pure galls and iron, or of some mixture in which these are the chief ingredients.

A small quantity of salicylic acid, one-half gramme to the liter, will prevent it from moulding even when kept in open ink bottles. This is far preferable to the bad smelling carbolic acid, or the very poisonous bichloride of mercury, so frequently used both in ink and mucilage to prevent souring, fermentation, or mould.

PROPOSED DIGEST OF PATENTS.

In his recent annual report the Commissioner of Patents, Mr. Marble, calls the attention of Congress to the necessity of having a digest made for the use of the office and the public, of the inventions patented in this and foreign countries. The preparation of such a work, he says, would cost a large sum of money, but he thinks the government would soon be reimbursed by its sale. The advantage to the public, especially to inventors and manufacturers, would be incalculable, and for these reasons he earnestly recommends Congress to take action looking to an early commencement of the work.

To prepare such a digest would, indeed, be an immense work, but there is no doubt of its value as an assistance to inventors in determining the probable novelty of their inventions, provided the books were kept up to date and made readily accessible to the public. To Patent Office examiners the work would be of especial convenience in helping them to reject new applications for patents.

A beginning of the proposed work might be made with the American Patents; and when that digest is complete then take up the foreign patents, as the latter would necessarily contain many repetitions of the devices found in the American patent lists.

But before anything is done in respect to this proposed compilation we would suggest that the Commissioner of Patents take steps to provide for the convenient access of the public to the printed patents that now exist in the Patent Office. This would seem to be a comparatively simple matter; but somehow or other it is hedged about with insuperable difficulties It is a curious fact that although the U. S. patents are printed in convenient form, and are public records, kept in a public building especially designed for the access and information of the people, still it is next to impossible for an individual to go to the Patent Office and refer to any complete part of the printed patents. For example, an inventor having made an improvement in flat irons, calls at the Patent Office and requests the privilege of looking over the various flat iron patents, with a view to applying for a patent if his supposed invention is new. He is shown sundry portfolios or volumes, purporting to contain all the previous inventions, finds nothing like his device, files his application, and is rejected. He then ascertains that some of the drawings or some of the patents, including the one resembling his device, had been temporarily removed, on some excuse or other, from the portfolio when he examined it, and that the set was not complete; so his examination was fallacious. He further finds that there is no uniform system followed at the Patent Office whereby the public may enjoy convenient and certain access to all of the printed patents in any particular class or branch. We suggest that before the new digest proposed by the Commissioner be commenced, the printed patents should be thoroughly classified, and several complete sets thereof maintained in convenient places for public reference.

We are inclined to believe that the Commissioner of Patents already has authority to establish such a system. Its efficient realization would be of great value to manufacturers, inventors, and all who are concerned in patent affairs.

THE SUN SPOT MAXIMUM.

We are now approaching the period when frequent and large sun spots may be expected. In 1870–71 this was the case, and the evidence is quite conclusive that they return with tolerable regularity at intervals of about ten or eleven years. As I write (January 28) there is in the sun's southern hemisphere, near the western border, a dark and conspicuous spot surrounded by a distinct penumbra. The umbra by itself is about 20 seconds in diameter, or in linear units about 9,000 miles, larger than the earth would appear at the same distance. There is also in the northern hemisphere a pretty group of four spots; and there are several others scattered about the surface of the sun. This is not very unusual. Spots have been recorded over 100,000 miles in diameter and visible to the naked eye, and as many as a hundred are sometimes noticed at one time. Frequently, however, the surface is entirely barren. The large spot mentioned above may almost be seen through a piece of smoked glass, and a spyglass of quite low power will render it easily visible. It is now moving off the disk; but in about twelve days it will probably return on the eastern edge; probably, but not certainly, for these large spots sometimes last for months and sometimes are dissipated in half an hour.

Care must be taken not to look at the sun through a telescope without the intervention of a piece of smoked glass over the eye end of the telescope. Loss of sight may result from neglect of this precaution. The best way to view the surface of the sun is to point the tube through a hole in the window shutter or other screen, and allow the image to fall on a piece of white paper, the eyepiece being first drawn out and the paper moved toward and away from it till the true focus is found. This gives a miniature but correct map of his surface, which can be seen by a number at a time without any risk or difficulty. If some of the readers of the SCIENTIFIC AMERICAN would keep a regular record of this kind, mapping and describing the phenomena observed systematically and accurately, they would find themselves much interested, and the records might have a scientific value. It is said of Schwabe, to whom we are indebted for more of our knowledge of the sun spot and associated phenomena than to any one else, that "twelve years he spent to satisfy himself; six more years to satisfy, and still thirteen more to convince mankind. For thirty years never has the sun exhibited his disk above the horizon of Dessau without being confronted by Schwabe's imperturbable telescope, and that appears to have happened, on an average, about 300 days in a year." This persistent work of observation, even sometimes with very limited means, has given us the reliable basis of theory; and there is nothing to hinder many an American observer continuing the record and keeping watch for the phenomena now to be explained, which seems to be associated with these sun spots.

These observations of Schwabe's, continued till 1868, and those of Wolf since, show very conclusively the ten year period above referred to. This being unquestionably determined, all kinds of eleven year cycles have been supposed to be discovered on the presumption that whatever affects the sun affects also all terrestrial activities. Herschel endeavored to show that the price of wheat changed with the sun spot period, being lower at times of maximum. But notwithstanding the authority of his great name, his success is very doubtful. Equally fruitless is the attempt to find an eleven year cycle coincident with sun spot maxima in the great financial panics and eras of commercial failures, which some Englishmen of good reputation have been recently indulging in. But there is one relation in which the observations are so complete that we may believe it to be established —the relation between photospheric activity on the sun and electrical activity on the earth. Through a long course of years it has been shown that the periods of magnetic variation coincide with the period of sun spots; not rigidly, but sufficiently close to prevent the probability of a chance connection. In at least one case, when observers have been looking at the sun through telescopes, and have recorded the exact instant of solar activity, the magnetic needles over the earth were violently affected, rigidly pointing out a new meridian. Auroras were noted, even in southern latitudes. Telegraphic lines refused to work, and shocks were given to the operators.

It is not difficult to explain a connection between earth currents of electricity, auroral display, and magnetic disturbance, but how these are caused by sun spot prevalency, or how a common cause produces all, is a problem which has not been satisfactorily solved. In the meantime it is well to heap up the records; to keep a close watch on the sun and note the size and character of his dark and bright spots; to look out also for auroras and record their appearance and duration; and for those who have opportunity to observe any especial disturbances in telegraphic currents and any odd freaks of the magnetic needle. I. S.

ANOTHER NEW DISINFECTANT.

Preserving and disinfecting agents have in recent times acquired an importance and scope regarding the methods of using them that could scarcely have been suspected at a relatively recent date. Dr. Koller cites, as examples, the antiseptic treatment of wounds which has been so exceptionally successful in the science of medicine. The discovery and application of true disinfectants and antiseptics may be designated as a most important practical question. The sanitary weal of the individual, of the masses, of cities, and of countries depends upon rational disinfection. The army of contagious diseases cannot be conquered by anything more successfully than by the weapons of disinfection.

The mutability, the changeableness, the self-sufficiency of the germs of decomposition and decay are characteristic of everything organic; but also characteristic of no men is that restless striving to lend a longer life, a quiet stability, to changeable nature. This conservative character is a feature of everything human; the shadows of the war for existence are sharply defined in this well-lighted picture, and time alone, with her flitting and varying forms, conjures up the conflict, whose final solution, however, only testifies to the old and innate conservatism.

The step up which the present has climbed in the recognition of disinfectants and antiseptics is quite a high one; but glancing back upon leaves of science, covered with glory, it is not difficult to predict that in this domain we shall still have many important advances yet to rejoice over.

At the head of the list of disinfectants which belong to modern times are carbolic and salicylic acids and thymol. A definite circle of action was found to belong to each when experience had leveled the way. Carbolic acid is in general the disinfectant of crude masses of organic substances; salicylic acid is the disinfectant of the kitchen, the cellar, and the larder, but thymol (most costly of all) is the disinfectant of the boudoir.

To the above mentioned must now be added a new one, says Andeer, viz., *resorcine*. Before we enter into a discussion of how it acts it is advisable to consider more closely its nature.

Resorcine was discovered about fifteen years ago by Barth and Hlasiwetz. At that time it was obtained as a product of the decomposition of certain gum resins like gum ammoniac, galbanum, assafœtida, etc., by fusing them with caustic potash; also by the dry distillation of Brazil wood. It derives its name from *resina*, resin, and orcin, a substance which it resembles, and which occurs ready formed in all lichens used for making litmus and archil, and is also obtained by the dry distillation of acids and ethereal bodies obtained from these lichens.

Sommer afterward called attention to the fact that umbelliferone, obtained from the umbellifera resins, when fused with alkalies gave the same substance. This umbelliferone crystallizes in colorless, odorless, and tasteless prisms, which are very soluble in boiling water, alcohol, and ether, and fluoresce strongly. It can be made from the resin which occurs as a drug in the market, or from the resin obtained by extracting angelica root, or levisticus, or imperatoria, with alcohol, and evaporating the alcoholic extract.

Resorcine belongs to the numerous compounds of benzole derivatives, especially to the dihydrox-benzoles or diphenols. A cheap method of making resorcine from benzole derivatives has been invented, and the dyes derived from it have justly attracted very extended attention.

Among the methods for making resorcine, the following are worthy of mention, because they furnish it at a reasonable price:

The chlorobenzol-sulpho-acid is made by dissolving chlorobenzole in fuming sulphuric acid. Its sodium salt when fused with caustic soda forms resorcine.

On warming a solution of phenol in sulphuric acid the metaphenolsulphonic acid is formed, and its sodium salt fused with caustic alkali also yields resorcine.

The third and best method, it seems, for making resorcine is from the dibenzolsulphonic acid, which is made by benzole vapors into warm sulphuric acid. A large quantity of resorcine is formed by fusing its sodium salt with caustic soda.

The relation that exists between resorcine and phenol (carbolic acid) as to their constitution led Andeer to ask whether their action might not be similar. In fact further experiments proved that resorcine has the property of stopping decay. Chemically pure resorcine, which withstands the light, when in a one per cent solution stops the development of fungi and mould. This has been proven not only by artificial experiments in the laboratory, but also chemically on the appearance of the symptoms of disease.

What seems deserving of special remark is that absolutely pure resorcine, in every degree of concentration, coagulates albumen and precipitates it from solution. On this account the author considers it an excellent caustic to remove unhealthy tissue. In crystals it cauterizes as powerfully as lunar caustic, but, he assures us, without pain, nor does it form metallic albuminates, which are insoluble or difficult of solution, causing a scar. In a comparatively short time, say three or four days, the skin regains its natural appearance.

In homeopathic doses the pure resorcine will preserve ink and colors which would otherwise mould very quickly, and not injure the color.

A one per cent solution will not prevent fermentation, but only retard it in favorable cases. To stop it completely requires a comparatively strong solution of 1½ to 2 per cent.

Andeer adds that resorcine is soluble in all liquids except chloroform and sulphide of carbon, and unites readily with animal fats and oils, especially in the presence of alkalies, and helps to emulsify them. Hence it is an antiseptic, caustic, to a certain extent a styptic, and an emulsifying agent. It has one advantage over the other disinfectants derived from benzole, that it can be used in every form prescribed by the pharmacopœia.

It seems that we are to be enriched by a new disinfectant which shall take a position in the future of unlimited usefulness. Resorcine will be the disinfectant, and in a certain sense the antiseptic of the physician, the druggist, and the laboratory.

MR. WATSON, in his *Mechanical News*, says that the best packing he ever used for faced joints, either steam or water, is common drawing paper soaked in oil. After a short time the heat of steam converts it into a substance like parchment, so that it is practically indestructible. It has the advantage of stripping readily from surfaces when it is desired to break a joint.

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ASBESTOS.

[*Continued from page* 127.]

location is a most convenient one in Brooklyn, at a point on New York Bay where there are admirable dock facilities for receiving and shipping goods.

Asbestos materials are woven, felted, or matted fabrics, and sheets of various fineness and thickness, used for filtering acids, for non-conducting and fireproof coverings, linings, and for many other purposes. Mill boards of one-sixteenth to one-half inch or more in thickness are used for packing gaskets around steam, fire, oils, and acids; also for fireboxes, coverings for locomotive boilers, etc. Sheathings, in sheets and rolls, make fireproof linings under weather-boards of wooden buildings, and in fire and boiler rooms. Steam packings, in the form of rope, wick, loose fiber, etc., are for use in stuffing boxes around valve stems and other moving parts of steam engines, acid and oil pumps. Cements and coatings in great variety are employed for repairing gas and other retorts, and for use around furnaces, acid works, etc.; roof cement for covering and repairing roofs, and jointing cement for steam and other joints; while the concrete coating is used for rendering beams, posts, girders, and other woodwork fireproof. The following facts are given under the authority of Mr. Johns: A stick of wood thus coated and thrown into their furnace, for experiment, was taken out in its original form after this exposure, the asbestos coating, however, then covering only charcoal. Fireproof paints are used for interior woodwork. The largest drygoods firm in New York had their stores and warehouses thus painted, the total woodwork covered amounting to four and a half acres. Besides the above are asbestos paper, thread, and numerous other articles, widely varying in their character and adaptations, which form an interesting portion of the business of the establishment, but they are less important to a large class of persons than H. W. Johns' asbestos roofing, liquid paints, and boiler coverings.

The department for the manufacture of asbestos roofing, and the machinery employed therein, which forms the subject of one of our engraved views, represents a branch of business to which Mr. Johns first devoted his attention, having commenced it in 1858. The machine which is shown in this department is the result of a long series of experiments by Mr. Johns, and by its use the whole operation of manufacturing roofing from the raw materials is completed. Some two miles of this fabric, about 40 inches wide, is turned out daily by this machine. It is furnished in rolls containing about 200 square feet each, and the covering of a roof is quickly accomplished. The Johns patent asbestos roofing differs from other composition roofing, and is claimed to be about equal to tin, while it costs only about half as much. Its structure will be readily understood from the small engraving. The actual thickness is about one-tenth of an inch. It consists of a manila lining, upon which is a layer of waterproof composition, then a strong canvas, another layer of waterproof composition, and a surface layer of asbestos-coated felt. This composition is claimed to be acid proof as well as

Roofing.

waterproof. It is also said to be equally adapted for use in all climates, and for flat or steep roofs. An occasional application, at slight expense, of the asbestos roof coating, keeps a roof in good order, and the white fireproof coating with which the surface is finished makes a light roof, which is not only air and water tight, but an effective non-conductor of heat, and one that will protect the roof against fire from adjoining buildings.

Asbestos roofing has been in use for many years, and it has met with the approval of manufacturers and railroad officers for roofs of railroad buildings, bridges, warehouses, and for factories, etc., for which purposes it is especially adapted.

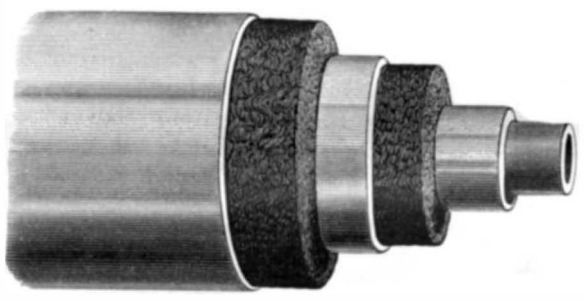
The utilization of asbestos in the manufacture of paints attracted the attention and became the subject of experiment with Mr. Johns at an early period in his investigations, and it forms a valuable ingredient in the fireproof paints referred to in the foregoing list of asbestos materials. This company also manufacture on an extensive scale a superior grade of pure linseed oil paints, in liquid form, for general structural purposes, which are designated by the peculiar trade-mark which is shown at the head of this article. Our artist has made two representations of departments where the manufacture of these paints is carried on, which give but an incomplete idea of the magnitude of this branch of the business. The manner of grinding and mixing is different from that followed in other establishments, and, although paints form only one of several classes of goods made by this company, their production in this class alone is claimed to be larger than that of any other manufacturers in this line in this country.

The purest linseed oil and colors enter into the composition of these paints, and they contain no water, alkalies, benzine, or other deleterious or useless adulterations or dilutions. They are furnished only in liquid form, ready for use, in all the standard shades, and of qualities

ASBESTOS GRINDING.

suited for out-door work or interior decoration. They work freely under the brush in cold as well as warm weather. They are not intended to compete in price with any of the low grade paints sold in the market, but the company claim that by their superior durability, they are less expensive than anything else offered in this line.

The way in which these liquid paints are ground and mixed is said to cause a more intimate combination of the



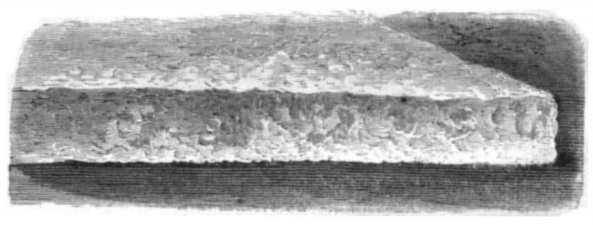
Pipe Covering.

ingredients than can be effected by the ordinary processes with oil and turpentine, and therefore greater richness and permanency of color and beauty of finish are attained. For roof painting the company have a special preparation which, either alone or in combination with their asbestos cement, they particularly recommend for rough usage and in exposed situations, and also for the preservation and repair of old leaky tin and other roofs. The roof paints are made in a variety of shades, and are durable preservative coatings for iron work exposed to the weather or in contact with the earth or salt water.

The use of asbestos, alone and in connection with other materials, for covering steam and hot-air pipes, boilers, etc., thus preventing the radiation of heat and economizing fuel, has formed one of its most popular and valuable applications. There are many different combinations and ways of applying it, and the company have patents on many feasible and valuable processes, extending back to its original adaptation to such uses, and covering also recent improvements. For pipe coverings they especially recommend their asbestos lining felt, a representation of which is given in our engraving. It consists of a pure asbestos sheathing, to one side of which is attached "flocked" asbestos. It is furnished in sheets and rolls, and forms an insulating cushion or non-conducting lining, over which is placed a layer of hair felt and then one of non-porous fireproof sheathing, while, if still further protection is required, another layer of hair felt surrounded by non-porous fireproof sheathing is added. The protection which this manner of covering affords, and the manner of its application, will be readily understood from the illustrations.

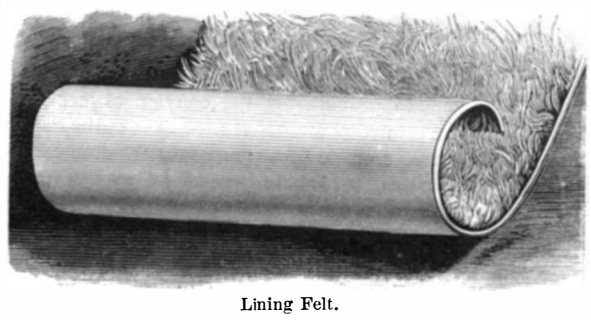
For boiler coverings, or where large surfaces giving out great heat are to be protected, the company recommend their asbestos cement felting, which partakes of the nature of a felt and a cement. It is composed of asbestos and a cementing compound, applied as a mortar, and forms a light porous covering, possessing superior non-conducting properties. It is claimed that there is no danger of its cracking from the expansion or contraction of the surfaces to which it is applied, the flexibility and strength of fiber of the asbestos keeping it always in its place, and it can be applied to heated as well as cold surfaces. In this connection we would state that the invention covering the application of this important function or use of asbestos, that is, the employment of its fibers as the indestructible binding or tying material in felts, cements, coatings, etc., in lieu of other fibers, such as hair and the like, as formerly used, was patented through the SCIENTIFIC AMERICAN office in 1868.

In the representation showing necessarily only a portion of the department for the preparation of crude asbestos for



Wadding.

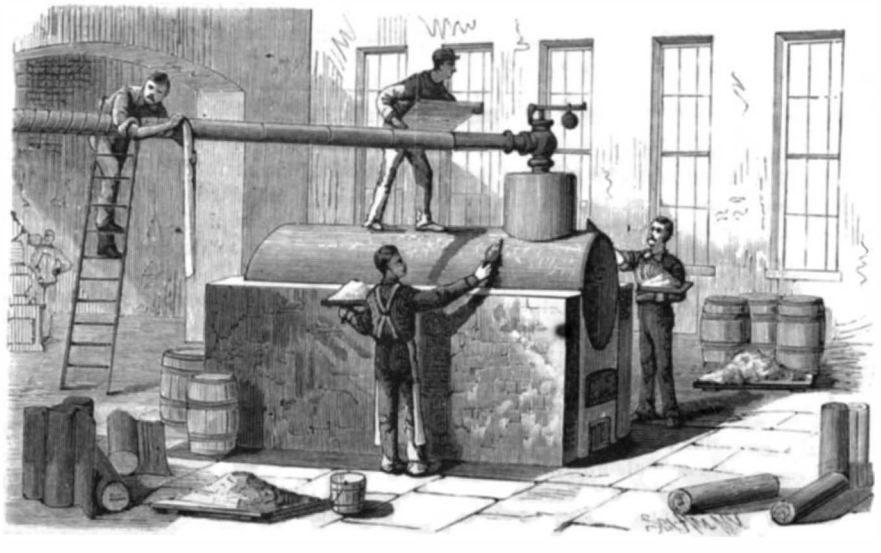
its manufacture into the various articles made at this establishment, are several machines designed especially for the purpose by Mr. Johns. The different kinds of asbestos, of which there is always an extensive variety on hand, require varying treatment, not only as to the goods to be made, but from the quality of the crude material, and it has only been by years of experience that the processes of manufacture have been perfected. Asbestos, of which we give an illustration of a fine sample from this country, comes in irregular solid blocks, generally not larger than stove coal, but



Lining Felt.

by a gentle attrition, without breaking the fiber, a piece as large as an egg may be made to fill a half-bushel measure of what looks not unlike the finest wool. Upon the length, strength, flexibility, and fineness of the fiber depends the value of the different varieties.

Prior to 1868 Mr. Johns had been for several years prosecuting experiments looking to the industrial utilization of asbestos. For a long time he found it extremely difficult to obtain such samples as were needed in making his experimental trials, and he was, for a period, accustomed to search the country for it, after the manner of an amateur geologist. He succeeded in finding some asbestos beds in the vicinity of New York; but when he had completed all the other preparations by which he would be able to put forth a manufactured article, it was a matter of grave doubt with him whether it would be possible to secure a permanent supply of the raw material. He, therefore, at the commencement of this enterprise sent out descriptive advertisements, in reply to which samples began to come in from various quarters, many of them not being asbestos at all, and others of little or no value; but in this way the supply has ever since been steadily increasing, so that in a little over thirteen years he has built up an entirely new industry of large magnitude, one which has proved of great value to the public, and for which there yet appears to be



BOILER AND PIPE COVERINGS.

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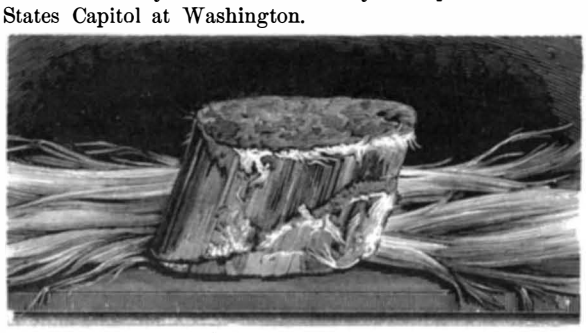
a wide field for future growth. It is worthy of mention that the largest contract ever made for paints, *i. e.*, that for painting the Metropolitan Elevated Railroad of this city, was awarded to this company, and their liquid white has been exclusively used for several years upon the United States Capitol at Washington.

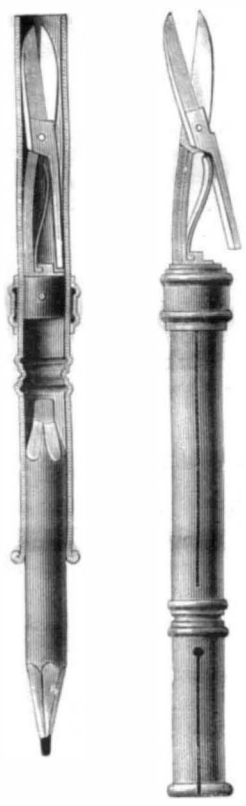


Asbestos.

The New York office of the company is at No. 87 Maiden Lane, where illustrated catalogues, descriptive of their inventions, can be obtained, and their goods are sold by dealers in all the principal cities and towns in this country and abroad. The London house of Messrs. Witty & Wyatt, No. 9 Fenchurch street, E. C., have the sale of these goods in Great Britain and the English colonies.

PENCIL HOLDER AND SCISSORS.

A handy combination of pencil holder and scissors is shown in the annexed engraving. The pencil holder may be of any of the usual forms. The one illustrated is what is known as a pencil-point protector, having a shoulder in the middle to limit the extent to which the pencil can be inserted. The tube beyond the shoulder is fitted to receive a small pair of scissors, which are attached to a block connected with an external sliding sleeve, by means of which they are projected from or drawn into the tube.



Benson's Combined Pencil Holder and Scissors.

This invention was lately patented by Mr. H. C. Benson, of New York city.

Action of Vegetable Acids on Tin.

Professor Charles E. Munroe, of Annapolis, states that the ordinary fruit acids, such as those contained in apples, tomatoes, rhubarb, lemons, etc., all acted upon tin. Some cider which he examined, and which had been stored in a tin fountain, contained 117 milligrammes of metallic tin to the liter in solution. One case was given where persons eating fruit preserved in tin cans were made violently sick, and tin only was found in the fruit. Corrosion of tin pipes by water was referred to, and it was suggested that the corrosion was due to the vegetable acids in the water.

NEW ICE CRUSHER.

We give an engraving of an improved ice crusher made by Thomas Mills & Bro., 1301 North Eighth street, Philadelphia, Pa., which is the result of a long experience both in the practical use and in the manufacture of machines of this class. The machine shown in the engraving is designed to be driven by power, but this firm also make crushers to be driven by hand.

The essential features of this machine are clearly represented. The movable and fixed spiked jaws converge, so that as a piece of ice becomes reduced in size by the crushing action of the jaws it continually falls until it is finally reduced to small pieces which come within the capacity of the speculated rollers at the bottom, which can be adjusted to crush the ice to any degree of fineness. Below the rollers there is a follower which pushes the crushed ice out toward the rear of the machine.

The largest of these machines will receive an ice cake weighing 100 lb., and will crush 10 to 12 tons per hour. The smallest machine takes a cake weighing 10 lb., and there are several intermediate sizes.

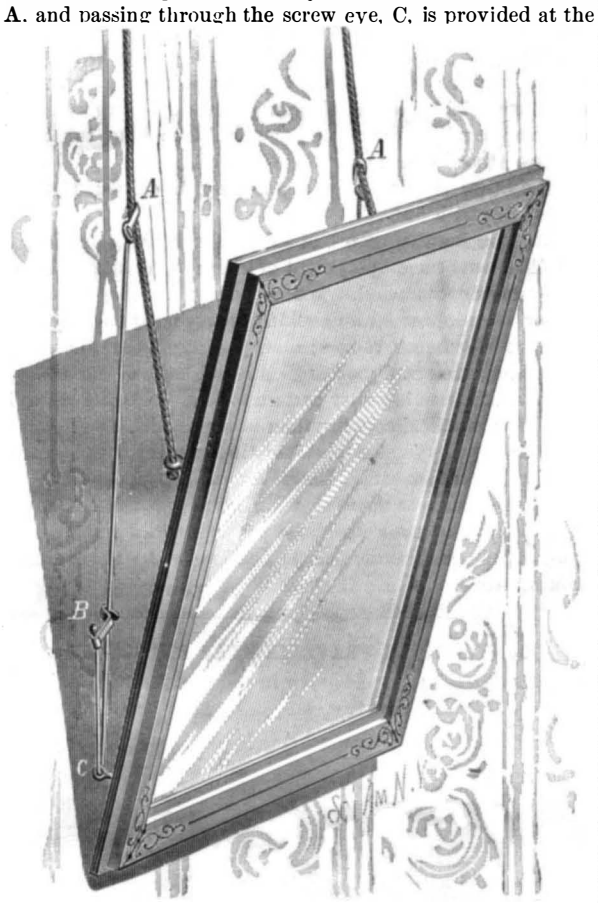
The advantage of this machine is that the ice can be rapidly crushed to a uniform size, insuring the degree of compactness most desirable for packing purposes.

These machines are in use by hotels, ice cream factories, fish packers, and private families, and are acknowledged to be efficient and satisfactory.

NEW ADJUSTER FOR MIRROR AND PICTURE FRAMES.

It requires no little skill to hang a series of pictures at a uniform angle, and it is often difficult to attach the cord to a mirror so that it will have the desired inclination without bracing or propping of some sort. To avoid these difficulties Mr. Charles A. Simpson, of Saxonville, Mass., has invented a very simple and inexpensive attachment for frame hangings, which is readily applied and holds the frame at any desired angle.

The frame is hung with cords in the usual way, but the screw eyes are so located that it may hang a little straighter than the desired angle. Near the lower corners, on either side of the frame, is placed a screw eye, C. A cord, D, attached to the picture cord by means of a common hook, A, and passing through the screw eye, C, is provided at the



SIMPSON'S ADJUSTER FOR HANGING FRAMES.

end with a flat hook, B, which clamps the cord by being canted by means of the weight of the frame. The hook, B, may be moved up or down on the cord, D, to alter the inclination of the frame. The adjustment is the same for both sides of the frame.

The advantages of this simple invention are too apparent to need recital here. It enables one to adjust his frames at any desired angle, and it insures their remaining in position.

Test of a Safety Elevator.

The proprietors of the Grand Central Hotel, in this city, recently gave a public exhibition of the efficiency of a safety air cushion which had been affixed to their large passenger elevator by the inventor, Mr. F. T. Ellithorpe. The elevator was, the makers claimed, the largest and heaviest in the world. The safety cushion consisted of a stout rubber bag, so placed beneath the floor of the elevator as to expand by the upward pressure of the air confined in the elevator shaft, and gradually arrest the fall of the elevator by filling the shaft like a piston head, and retarding the escape of the air from a closed well at the bottom.

In making the test the supports of the elevator were severed, and the elevator was allowed to drop a distance of 123 feet, retarded only by the safety cushion. The inventor had faith enough in his protective device to trust his life to it, and made the hazardous trip not only without harm but without serious discomfort. The motion of the elevator was arrested with so little shock that several eggs on the floor were not cracked, nor was a goblet of water overturned. No record was made of the pressure of the air in the well or of the time covered by the fall. The motion of the elevator was very rapid until within a few feet of the bottom. The efficiency of the safety cushion was amply demonstrated.

Iridium for Electric Lights.

The latest material offered for an incombustible "burner" for the electric light is iridium. Mr. Holland, gold pen maker of Cincinnati, claims to have discovered a flux by means of which he is able to fuse iridium in an ordinary draught furnace. He casts the metal in any shape desired, and in bars or ingots weighing as much as ten ounces. The metal thus fused and cast defies the file and resists all acids. The only mechanical way of cutting it is by friction with a copper wheel charged with diamond dust or fine corundum. Mr. Holland claims, further, that the cast iridium makes suitable "burners" for the electric light, and that so used the metal is durable without protection from the atmosphere.

IMPROVED HAND HOE.

The engraving shows an improved hand hoe adapted to universal use in the cutting away of grass or manipulating the soil about plants. The novelty consists in the peculiar form of the blade, which is constructed of a main body portion setting off to one side of the longitudinal axis of the handle in a parallel plane therewith, and a curved or upturned end portion, which, as well as the main portion, is sharp upon both edges.

This useful tool was recently patented by Mr. Robert L. Turner, of Olena, Ohio.

Turner's Hand Hoe.

RECENT INVENTIONS.

Mr. George W. McKenzie, of Dyersburg, Tenn., has patented an improvement in baling presses by which great pressure is exerted upon the bale, and which is easily and rapidly operated. A hinged lever, connected with the follower and provided with a clevis, pulleys, and rope for actuating the same, are the principal features of the improvement.

Mr. Thomas D. Gallagher, of Cleveland, Ohio, has patented an improvement in stock cars, which supplies readily detachable troughs for feeding and watering cattle during transportation. The trough is attached and detachably secured on the outside of the car by flanged edges working over longitudinal braces on the car.

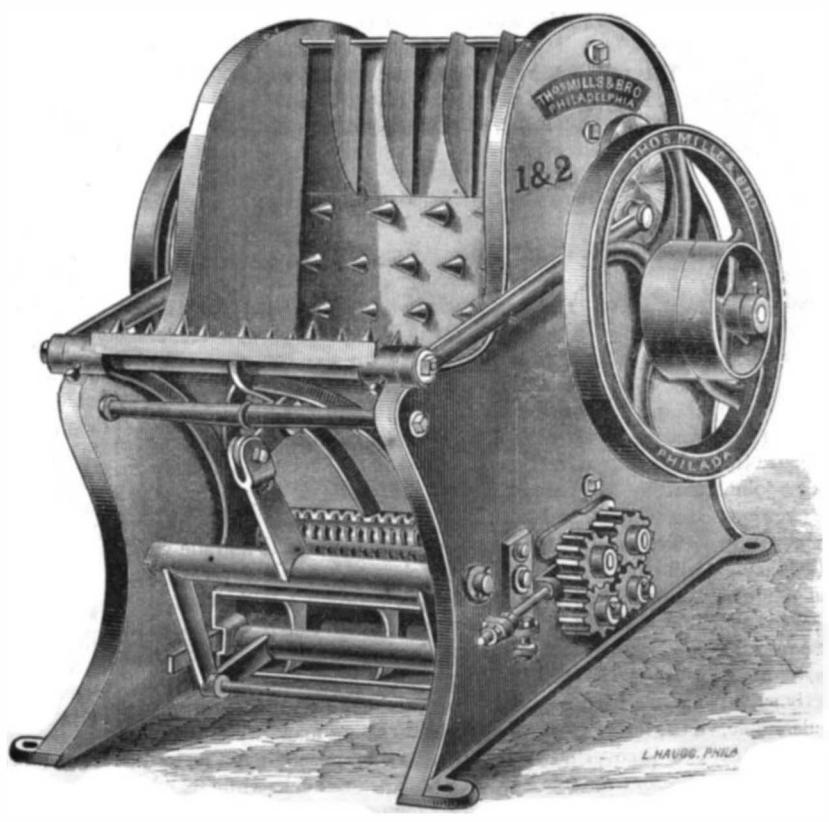
Mr. Ross Hall, of Millersburg, Ohio, has patented an improved stove of that class having exterior attached reservoirs or feeders delivering coal into the lower part of the fire pot. The arrangement is such that the combustible gases evolved by heat from the coal in the lower part of the fire pot pass up through the incandescent coal, where they are consumed and add to the heat of combustion.

Mr. Henry H. Spencer, of Mound City, Ill., has patented a rotary spading machine which imparts to the spades a compound rotary and reciprocating movement, their rotary motion being temporarily arrested while they enter the ground without checking the movement of the carriage or causing strains upon the gearing, and at a suitable moment withdraws the spades, completely frees them from the earth, and turns the latter over.

Mr. Abel Henning, of Easton, Md , has patented an improved carbureting apparatus, in which a peculiar arrangement of parts causes the pump which feeds the oil to a mixing chamber to be operated by the same power which actuates the air blower. Peculiar devices for volatilizing the oil and mixing the vapors with air are also supplied.

Mr. Samuel T. Richardson, of Cambridge, Md., has patented a lever power and dredge winder, designed more especially for oyster dredges, but applicable to analogous purposes, which not only much reduces the very hard labor of dredging in the ordinary way, but also avoids the danger to life and limb caused by oyster dredges catching on a rock.

Mr. Jacob Katzenberg, of New York city, has patented an improvement in suspenders



IMPROVED ICE CRUSHER.

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whereby they may be made cheaper and yet be strong, more durable, and more ornamental, with due elasticity.

Messrs. James Semple and Wilkinson Crossley, of Broad Brook, Conn., have patented an improved apparatus for extracting dyes, which consist of an upright cylindrical vessel containing horizontal plates for supporting the dye stuffs, provided with pipes for introducing steam, boiling, drawing off the extract, and forcing the latter from the vessel, and also provided with appliances for introducing the unleached dye stuff and removing the spent stuff. Devices for regulating the process are also supplied.

Mr. Thomas Robinson, of Newtonville, Ind., has invented a potato-bug catcher, so constructed that the insects can be conveniently caught and removed from potato vines and other plants. The device consists of a box having an inclined apron and extended sides to receive the bugs, guard plates to prevent the bugs from shaking out, guard plates to intercept the flying bugs, and a socket and handle for carrying the implement.

Mr. Thomas M. Ullery, of Wakefield, Kansas, has patented an improved lime kiln, which provides means for separating the burned lime from the ashes of the fuel, and for facilitating the drawing of the lime from the kiln. A horizontal shoveling plate is placed between the mouth of the kiln and the ashpit, coming short of the rear wall of the throat or opening into the bottom of the kiln, and supporting a grate inclined upward and backward from the rear of the shoveling plate to the rear or back part of the throat. In passing down the inclined grate the burned lime is separated from the ashes.

Mr. Frederick F. Bioren, of Newark, N. J., has patented an apparatus for removing snow from streets and railroads. An oil tank is provided with a series of wick tubes, and a fan blower provided with corresponding pipes that operate as blow-pipes to direct the air from the blower forcibly upon the flames issuing from the wick-tubes, thereby forming blow-pipe flames which are directed upon the snow or ice to be removed. A combustion chamber which can be vertically adjusted to protect, direct, and concentrate the flames is used, and the entire apparatus is mounted on a wheeled platform, to be drawn along the surface of the street as may be required.

Mr. James Simmons, of St. Louis, Mo., has patented an improved icebox, which has its main frame and walls so constructed that the refrigerator may be taken apart and closely packed for shipment, and put together again for use when wanted.

Mr. Robert H. Dimock, of New Haven, Conn., has patented a marine paint and process for manufacturing the same. The paint consists of linseed oil with certain preparations of copper incorporated therein to make a paint poisonous to animal and vegetable life.

Mr. Solomon B. Elithorpe, of Rochester, N. Y., has patented a lasting machine, which combines in a suitable frame a seat for holding a last, flanged levers for fitting the leather about the last, a vertically adjustable templet provided with clamps and pressing screws for holding and stretching the leather upon the last, and a gathering cord for holding the leather so stretched.

Mr. Joseph Johnson, of Lebanon, Ohio, has patented an improvement in harness, consisting in a novel construction and arrangement of devices used in connection with the back strap and collar, whereby provision is made for dispensing with traces or tugs for pulling, and with breechings for holding back.

COOKING BY STEAM.

In the popular mind steam cooking is associated with charitable soup kitchens, public poorhouses, prisons, and similar institutions, where sodden and unsavory food is turned out wholesale for uncritical palates. To apply steam for the finer work of the civilized kitchen is quite another matter; and to those who are unfamiliar with recent progress in this direction it seems little less than incredible that steam cooked food can, in range or quality, bear any comparison with that prepared by a skillful cook at an open fire. Yet it would seem to be precisely in the matter of quality in the product that steam is likely to prove most serviceable as well as most economical in the kitchen.

The one thing essential to good cooking (presupposing, of course, an intelligent cook and a proper supply of raw materials) is a supply of heat properly distributed and under perfect control as to intensity. These conditions are not easily met with direct fire heat, and when met necessitate incessant vigilance on the part of the cook to prevent such variations in the heat of the fire as may injure the quality of the food in preparation. Even with the utmost vigilance much food is overcooked either by miscalculation or to secure the proper cooking of the rest. In roasting and browning a joint, for instance, the thinner portions are very apt to be overdone or dried while the thicker parts are being sufficiently cooked.

With steam cooking, under proper conditions as to apparatus, these difficulties are entirely done away. With the same source of heat supply a dozen ovens in a row may be kept either at the same temperature steadily hour after hour, or each may be maintained at a temperature exactly suited to the work to be done in it, and varied as may be desirable, without affecting in any way the rest. This puts the work of the cook upon a strictly scientific footing, the various operations being individually and collectively under perfect control, thus ruling out entirely the large and wasteful element of uncertainty, which costs so much in spoiled food and spoiled temper under ordinary kitchen conditions.

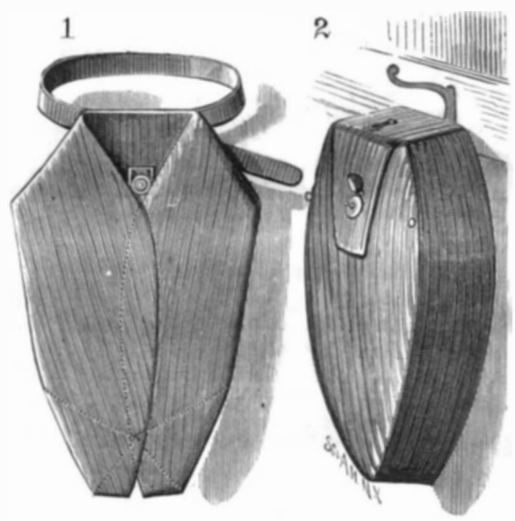
A practical illustration of these truths, as well as of the capacity of steam cooking to cover the entire range of culinary processes, is furnished daily in the extensive kitchen of the well-known restaurant of Messrs. Crook & Nash. This establishment, which ranks among the first in New York in respect to age, size, and the quality of the cooking, has lately been refitted and provided with a complete outfit of steam appliances on the patented system of Mr. John Ashcraft. No fire is used in the kitchen, the steam being taken from an adjoining building and distributed in pipes to the various sets of cooking apparatus. For baking, roasting, broiling, and other operations requiring a dry heat, the steam surrounds the cooking chamber, but does not enter it. Boiling is done either in jacketed vessels surrounded by steam, or as in cooking vegetables the steam is directly admitted to the articles, which are cooked in their own juices with no wastage of material or flavor. The meats cooked by this method are exceptionally tender and juicy, and free from the flavor of gases absorbed from the fire, the taint of scorched flesh or fat, and other unsavory qualities usually developed in irregular cooking with fire.

With the increasing use of steam in dwellings and larger establishments the employment of steam in cooking is likely to be greatly extended. Where public systems of steam heating are adopted steam cooking stoves must entirely take the place of existing ranges; and, judging from the result obtained by Messrs. Crook & Nash and others, the change from fire to steam is pretty certain to lead to better as well as more economical cooking than now prevails.

Great economy is also possible through the employment of the waste steam of factories for culinary purposes. In many cases the heat now thrown away in waste steam would amply suffice to cook the food of the workmen and their families and do it better than is possible with the ordinary cooking stove.

CONVERTIBLE TRAVELING CAP AND SCARF.

The article of apparel shown in the annexed engraving is designed especially for travelers' use, and is convertible into



CONVERTIBLE TRAVELING CAP AND SCARF.

what is known as a "flat scarf" and into a cap, answering an excellent purpose in either capacity. The top of the article is made in the form of a cap, and the flexible side portions fold in when the article is used as a scarf. A clasp is secured to the top, which is engaged by eyes attached to the sides when they are closed down upon the top. By unclasping the sides and unfolding them, a comfortable cap is formed.

This article has been patented by Mr. A Weiler, of Crefeld, Prussia.

Substitutes for Lumber.

We are in receipt, from Mr. S. W. Hamilton, of Lawrence, Kansas, of a sample of lumber made from straw, manufactured after a process patented by himself, the particulars of which he does not explain. He informs us, however, that he can manufacture lumber like the sample sent, in any desired length, from 12 feet upward, and to 32 inches in width, at a cost competing with the better or finishing grades of pine, although he does not inform us whether this competition will apply equally to sections where lumber is comparatively cheap, as at Chicago, and at Western grain producing points, as at Kansas. We imagine, however, that the expense will vary but little at any point where straw is obtainable in large quantities.

The manufacture is, of course, confined to a grade which will compete with the better class of lumber, as there would be no object in filling the new product with knots, and shakes would scarcely be obtainable even if desired, while sap and decayed wood must be impossibilities. The sample sent to us will hold a nail as well as wood, is equally susceptible to a high painting finish, and can be polished to as high a degree as is at all desirable. Being made waterproof, we can discover no possible reason why it should not be as durable, or even more so, than pine or even oak, while its adaptability is evidently as great for roofing purposes, as for the fine work of a dwelling.

The question of cost appears to us to be the most important element yet to be practically solved. We can see no reason why it is not susceptible of being worked under the plane or other ordinary tools of the carpenter, and when once fitted to its place, we can readily believe that it will be free from shrinkage or swelling. In appearance, the sample before us resembles hardwood, being about as dark as oak and more dense in texture, with a specific gravity one-fifth greater than thoroughly seasoned black walnut. For finishing purposes, it will not, as a rule, be necessarily as thick as ordinary lumber, its tensile strength being apparently double that of wood of the same thickness. On the whole, we are favorably impressed with the appearance of the new artificial lumber.

In connection with the new styles of building material, we may mention a new block of buildings now in course of erection on the corner of Randolph and Dearborn streets in this city, the facings and trimmings of which are wholly of terra cotta, which is another name for baked clay. These trimmings are moulded to the desired shape, and may be made as highly ornamental as is the carved pattern in which they are formed. By adding a mixture of sawdust with that portion of the clay which does not require a finished surface, the block may be reduced in any reasonable degree as regards weight, while, being hollow, a large piece is comparatively light. The faces being made of finer clay, carefully moulded, present a finished character, and the block as a whole presents as rich an appearance as any in this city of elegant buildings, and is in favorable contrast with the massive stone pillars of the lower part of this or the surrounding buildings. It is evident that inventive art combined with æsthetic taste will, in the future, readily adapt itself to the demands of civilization, and while building timber may grow scarcer, succeeding generations will think of the age of wood as well suited to the needs of a generation which, in its rapid settlement of a new country, found it indispensable, at the same time congratulating themselves upon the possession of more durable, fully as ornamental, and equally as cheap a substitute in clay, glass, paper, and iron. We may speculate upon the details of architectural estimates in the future as including paper for doors and window frames, floors, mouldings, and roof; glass for porches and pillars, as well as for lighting; terra cotta for window caps and sills, and as well for cornices and walls; and iron for beams, joist, and rafters, with not a sliver of wood in the whole construction. Future generations will realize what at present we but anticipate.—*N. W. Lumberman.*

INTERNATIONAL GEOGRAPHICAL CONGRESS.

The Italian Geographical Society, to whom the direction of the Third International Geographical Congress has been committed, announce that the meeting will be held this year in Venice, September 15 to 22.

The Third International Geographical Exhibition will be held at the same place, beginning September 1 and closing October 1.

The preparatory work of the Congress and the Exhibition has been intrusted to a managing committee, presided over by the President of the Italian Society. It is probable that the Congress will be divided into seven scientific groups:

1. Mathematical Geography, Geodesy, Topography.
2. Hydrography, Maritime Geography.
3. Physical Geography, Meteorology, Geology, Botany, Zoology.
4. Historical, Ethnographical, Philological Geography; History of Geography.
5. Economical, Commercial, Statistical Geography.
6. Methodology, Tuition and Diffusion of Geography.
7. Explorings and Geographical Travels.

The Congresses at Antwerp, in 1871, and at Paris, in 1875, were very successful, and have had an important influence on the progress of geographical discovery. Correspondence, whether with regard to the Congress or the Exhibition, should be addressed to the Managing Committee of the Third International Geographical Congress, 26 Via del Collegio Romano, Rome.

Explosive Medical Compounds.

The medical and pharmaceutical journals have recorded a number of cases of explosions having taken place by the admixture of explosive substances. Among the prescriptions having given rise to such accidents we will mention the following: 1st. Mixture of hypophosphite of lime, 50 centigrammes; chlorate of potash, 3 grammes 75 centigrammes; lactate of iron, 30 centigrammes. 2d. Solution of glycerine, 8 grammes, in acid chromic, 4 grammes. 3d. Mixture of chlorate of potash, tr. ferri perchlorid. and glycerine has exploded in the pocket of a patient. 4th. Chlorate of potash mixed with catechu and used as a dentifrice, may explode in the mouth of the patient, provided hard friction is used. 5th. Pills of oxide of silver (frequently used in England in affections of the stomach) have exploded in the patient's pocket. Pills of permanganate of potash and ferri reduct., pills of golden sulphur of antimony and chlorate of soda, may explode during or after their preparation. It is, therefore, essential to avoid associating glycerine, and, in general, substances easily reduced, with such oxidizing agents as chromic acid, chlorates, permanganates, and certain organic acids.—*Bull. gén de thérapeut.*

A FAST ATLANTIC PASSAGE.—The Arizona, of the Guion Line, arrived at Queenstown February 2, having made the quickest trip on record. The time from New York was 7d. 22h. 23m.

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ELECTRO-METALLURGY.

CLEANSING AND PREPARING OBJECTS FOR ELECTRO-PLATING.

The first and most important operation in the electro-deposition of one metal upon another is to effect a thorough chemical cleansing of the surface of the metal upon which the coating is to be deposited, for if this is not accomplished the deposited metal will not adhere to the surface.

In cleansing, different metals usually require a somewhat different treatment.

The surface of most metals when clean soon become coated with a film of oxide when exposed to the air, especially when the surface exposed is wet, and to avoid this it is usually necessary to proceed with the plating immediately after cleansing.

Before proceeding to cleanse the articles they are usually "trussed" with copper wire to avoid the necessity of handling them during the operation or afterward, until the plating is finished. A very slight contact with the hand is often sufficient to make a second cleansing necessary.

If the article to be plated presents a smooth-finished or polished surface the deposit will be "bright." If, on the contrary, the surface is rough or unpolished the deposit will ordinarily have a dead luster. If left too long in the acid dips used in cleansing, a polished surface is apt to have its finish deadened.

No interval should be allowed between the various operations of cleansing.

CLEANSING COPPER AND COPPER ALLOYS.

Potash, caustic	1 pound.
Water, soft	1 gallon.

Heat nearly to boiling in a cast iron pot provided with a cover.

Brush to remove any loosely adhering foreign matters, truss, and suspend for a time in the hot lye; usually a few minutes will suffice if the article is not heavily lacquered. If any of its parts are joined with solder it should not be allowed to remain too long immersed, as the caustic liquid attacks solders and their solution blackens copper. On removing rinse thoroughly in running water.

If the articles are much oxidized, pickle in a bath composed of—

Water	1 gallon,
Sulphuric acid	1 pint,

until the darker portion is removed. Rinse in running water and dip in the following solution:

Water, soft	1 gallon.
Cyanide of potassium, common	8 ounces.

Remove from the bath, and quickly go over every part with a brush and fine pumice stone powder moistened with the cyanide solution. Some electroplaters prefer to give the articles a preliminary "brightening dip" in nitric acid, or a mixture of nitric and sulphuric acids and salt, followed by rinsing in water; but the cyanide, aided by the mechanical action of the pumice and brush, does very well without it in most cases. After the scouring dip the work momentarily in the cyanide solution, rinse quickly in running water, and transfer immediately to the plating bath.

Where the article is to receive a deposit of gold or silver its surface is usually softened by slightly amalgamating it with mercury, to insure perfect adhesion of the deposited metal.

The amalgamating is performed by dipping the article, after the cyanide scouring operation, for a few seconds in a solution of—

Mercuric nitrate	½ ounce.
Sulphuric acid	½ "
Water	1 gallon.

Stir until the solution becomes clear before using. Rinse the work quickly on coming from the mercury dip, and transfer to the plating solution.

The acid, cyanide, and mercury dips may be kept in glass or stoneware jars (avoid jars with lead glazing) provided with covers to prevent evaporation.

A "dead luster" is imparted to articles of copper or copper alloy by dipping them for a few minutes in a bath composed of

Nitric acid (36°)	20 pounds.
Sulphuric acid (66°)	10 "
Salt	1/16 pound.
Zinc sulphate	1/16 "

Mix the acids gradually, add the zinc salt, then the salt, a little at a time (out-of-doors to avoid the acid vapors), stir well together, and let it get cold before using. Rinse thoroughly, and pass through the cyanide before putting in the plating bath.

CLEANSING CAST IRON.

Cast iron is freed from grease, etc., by dipping in hot alkali solution used for a similar purpose with copper, and after rinsing thoroughly is pickled in water containing about one per cent of sulphuric acid for several hours; then rinsed in water and scoured with fine sharp sand or pumice and a fiber brush. It is then rinsed and returned to the acid pickle for a short time, rinsed again, and put into the plating bath directly. If more than one per cent of acid is used in the pickle the time of immersion must be shortened, otherwise the iron will be deeply corroded, and the carbon which the metal contains, and which is not affected by the acid, will not yield without a great deal of labor to the sand and brush.

Cast iron does not gild or silver well by direct deposit. Copper or bronze deposits are better, though not perfect; but if the iron is tinned the coat is adherent and will readily receive the other metals.

CLEANSING WROUGHT IRON.

The cleansing of wrought iron, if much oxidized, is effected in the same manner as cast iron; but it will bear a stronger pickle and a longer exposure. Whitened, filed, or polished iron may be treated like steel.

CLEANSING STEEL.

Dip in the caustic lye used for copper, etc., rinse thoroughly, scour with pumice powder moistened, rinse, and pass through the following dip:

Water	1 gallon.
Hydrochloric acid	4 pounds.

Rinse quickly (but thoroughly) and plunge in the bath.

Clean wrought iron and steel gild well without an intermediary coating in hot electro-gilding baths. It is difficult to obtain an adherent coating of silver on these metals without interposing an intermediate coating of copper or brass, which renders the further operation of silver plating easy.

CLEANSING ZINC, TIN, AND LEAD.

Zinc is cleansed by dipping for a few moments only (as the alkali quickly attacks the metal) in the hot potash lye, rinsing, and dipping into water containing about ten per cent of sulphuric acid for a few minutes. Rinse in plenty of hot water, and, if necessary, scour with pumice stone powder and a stiff brush, moistened with a weak cyanide solution, or scratch brush. This last operation is especially useful when parts have been united with tin solder.

Tin, lead, and the alloys of these metals are more difficult to cleanse perfectly than zinc or iron. Scour rapidly with the hot potash and brush, rinse quickly and brush, or dress with a piece of soft clean wood. It is very difficult to obtain a satisfactory deposit of gold or silver directly upon these metals or their alloys. The results are much better if a coating of pure copper is interposed.

SCRATCH BRUSHING.

The scratch brush is often resorted to to remove the dead luster on or to impart a smooth surface to an object. They

are usually made of brass or steel wire, and of a variety of shapes to suit the object. Some of the forms are shown in the figure.

The wheel brushes are used on the lathe, the objects being manipulated in contact with the rapidly revolving brush. The brush is usually kept moistened by a small stream of water while in use.

Ancient Works in New Mexico.

New Mexico is perhaps the most noted country in the world for research. The historian, the wealth seeker, and the "curious" can here find a rich field and reward for their labor. The Abo and Gran Quivira counties are perhaps the most renowned in the Territory for research. In the former there are evidences of great volcanic eruptions which overwhelmed cities and buried the inhabitants in ashes and lava long ages ago. It is evident that these people, who are perhaps older that the Aztecs, were a prosperous race, with not a little advance in civilization, as the Abo ruins in the Manzana Mountains indicate; also some indications of fine art; rude figures and the images of animals being found upon the interior of the walls of the structures beneath the *débris*.

It is evident that this non-historic race were seekers after mineral, and evidences also exist that mineral was obtained by them in paying quantities, there being the ruins of many old smelters and acres of slag found near Abo. Here mines are found with the timbers so rotten with age that great difficulty is experienced and danger incurred in going down into the old shafts, where shafts are formed.

One of our informants gave as his belief that either the flow of lava or falling leaves and dust had filled many of the shafts up, and the sand, earth, and leaves so completely covered the ground that great care is required to find them, with but one or two exceptions—the Mount of the Holy Cross (so named) being about the only one that could be easily discovered.

One especially was found where human hands or lava or falling leaves and dust had filled it level with the earth, no shaft being discernible, and would not have been found, perhaps, had not an old trail been discovered. This was dug into, and at a depth of twelve feet a man could, in places, thrust his arm in up to the elbow between the granite walls of the mine and the earth which filled the old shaft. The mineral, unlike our White Oaks country, does not seem to outcrop, but seems to be deep in the earth; no float having been found as yet except near the shafts or around the old smelters. On the eastern slope of the Manzana Mountains no quartz has been found excepting in a very burned and blackened condition. This part of the country will perhaps yield immense mineral wealth in time, and further developments and prospecting are awaited with great interest to many.

The walls of some of the old ruins at Abo are six feet of solid stone—lime and red sand—the walls in places are yet six feet in height and in a state of perfect preservation. In the ruins are found vessels of various designs and sizes made of pottery—some representing birds and animals. Stone hammers are found here, but no indications that sharp-edged tools were used in this ancient period. In digging down one place the remains of an old aqueduct was found, which was probably used, as in the present day, by the Mexicans for supplying the inhabitants with water.

It is thought and believed, by specimens of ore found, that gold, silver, and copper were found in paying quantites. All the rock is more or less copper stained, and some of it is so much so that some of the "country" rock has run as high as 37 per cent copper.

Surely our bright, sunny land has been enjoyed long before the Anglo-Saxon made his appear once upon the scene. The future of New Mexico can only be surmised. Every day new evidences of untold wealth are thrust upon us, and the day is not far distant when the multitudes of the East will flock to our borders and assist in the development of the greatest mineral region in the world.—*Era*.

The Brush Electric Light in London.

Very remarkable progress continues to be made with the installation of the Brush electric light by the Anglo-American Electric Light Company, says *Engineering*. The Great Western Station at Paddington has been most successfully lighted by thirty-two Brush lamps, and we believe this company proposes to light up their goods station at Smithfield as well as the principal stations along their line by the same system. The Charing Cross Station of the Southeastern Railway Company has been now lighted for more than a week by sixteen Brush 2,000 candle lamps worked by a dynamo-electric machine in the Anglo American Electric Light Company's Works in Lambeth. The globes used at Charing Cross are very similar to Sugg Albatrine globes, and give a very soft light, of which, however, far too much appears to be lost by diffusion toward the roof. Some other large metropolitan terminal stations will also be shortly lighted by the same system. In the provinces Messrs. John Bright Brothers, of Rochdale, Messrs. Horrockses, Miller & Co., the Blaina Iron Company, and Messrs. Courtauld, of Bocking, in Essex, are among the most recent users of the Brush system. The Bristol municipal authorities completed a series of experiments on Saturday last, to which we refer in more detail in our Notes from the Southwest, with a view to lighting the main streets of that city with the same system: the results obtained were in all respects satisfactory. Similar steps are being taken by the municipal authorities of several large continental towns, and also of towns in India with the same object. In Palace Yard Westminster, the number of Brush lights will be increased in a few days. There can be no doubt that this system fully merits the favor thus being so widely extended to it.

The New Orleans Cotton Exchange Building.

The attention of architects is invited to the professional opportunity offered in the competition of plans for a cotton exchange building in New Orleans, advertised in another column. The building is to be four stories in height, with an attic or mansard, absolutely fireproof as to elevator shafts and stairways, and as nearly fireproof elsewhere as can be without the use of iron.

The cost of the building, complete, is not to exceed $150,000. The nature of the cotton business and the peculiarities of the climate of New Orleans necessitate large window spaces for light and ventilation, and a plan of building adapted to strong architectural effects. A premium of $1,000 is offered for the design chosen (to be submitted on or before March 15, 1881), with $500 additional for details and specifications in case they may be required. Particulars with suggestive sketch-plans may be had on application to Henry G. Hestor, secretary of the New Orleans Cotton Exchange, New Orleans, La.

Preservation of Meat by Dextrine.

In the *Comptes Rendus* of the French Academy for December 6, there is a note by M. J. Seure on some experiments made by him in drying and preserving meat by means of dextrine.

Of the three specimens exhibited before the Academy the first was a slice of lean meat which had been buried in dextrine and left exposed to the air on a shelf in a closet for twenty months. The meat had become mummified; but, on putting it in water, it separated from the dextrine and assumed its original physical character. The second was meat which had been chopped up coarsely and mixed without any particular care with dextrine, so as to obtain a thick paste. This paste was dried in the air, and retained its properties like the former. The third was meat beaten to a fine pulp with dextrine and run into a mould, the result being a very hard, dry, homogeneous cake of a handsome appearance. Each of these specimens when exhibited had been preserved for the same length of time—twenty months.

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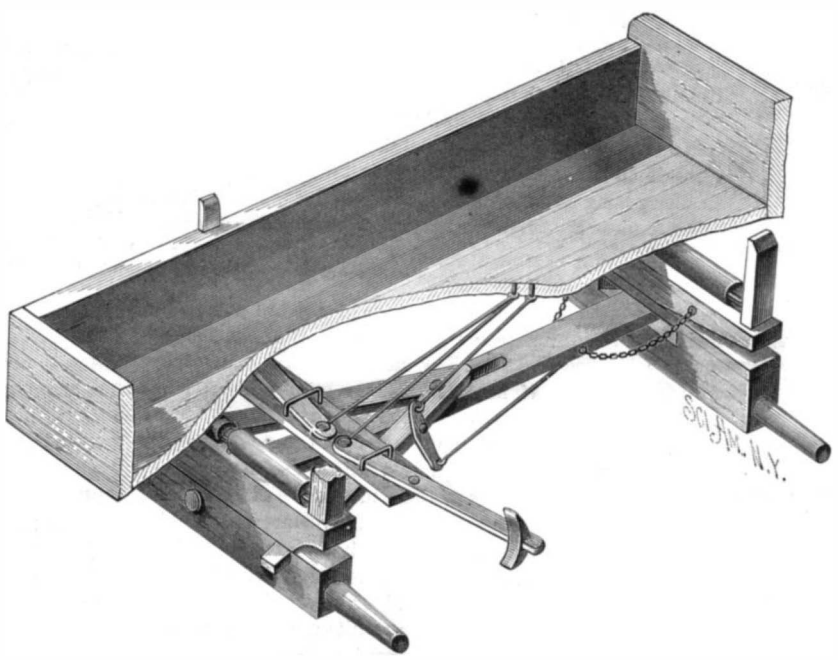
IMPROVED WAGON BRAKE.

We give herewith an engraving of an improved automatic wagon brake recently patented by Mr. A. L. Withers, Jr., of Summit Point, W. Va., which is operated by a forward motion of the load on its roller supports on the bolsters. The connection of the rear hound with the reach is by means of a bolt or stud extending through a slot in the reach, and permitting the hound to move through a limited distance. A cross bar secured to the hound carries two brake levers, projecting in opposite directions, having at their outer ends shoes which are capable of pressing the peripheries of the rear wheels of the wagon. These brake levers are pivoted about centrally to the cross bar, and their inner ends are connected by rods or chains with the bottom of the platform or wagon body, so that should the body move forward more or less on its roller supports, as in going down hill, the brakes will be automatically applied to the wheels.

A short lever pivoted to the side of the hound has its shorter arm connected by a rod or chain with the wagon body, and the longer arm is connected with the king bolt of the wagon by a rod or chain.

When the wagon reaches a level, the reach being drawn forward, the chain or rod connecting the short lever with the king bolt is drawn upon, moving the lever and drawing the wagon body backward, releasing the brake shoes from the wheels. The forward and backward movements of the body are limited by suitable stops.

This simple apparatus is entirely automatic, and applies the brakes with more or less force according to the requirements of the case, and it may be readily adapted to any wagon.



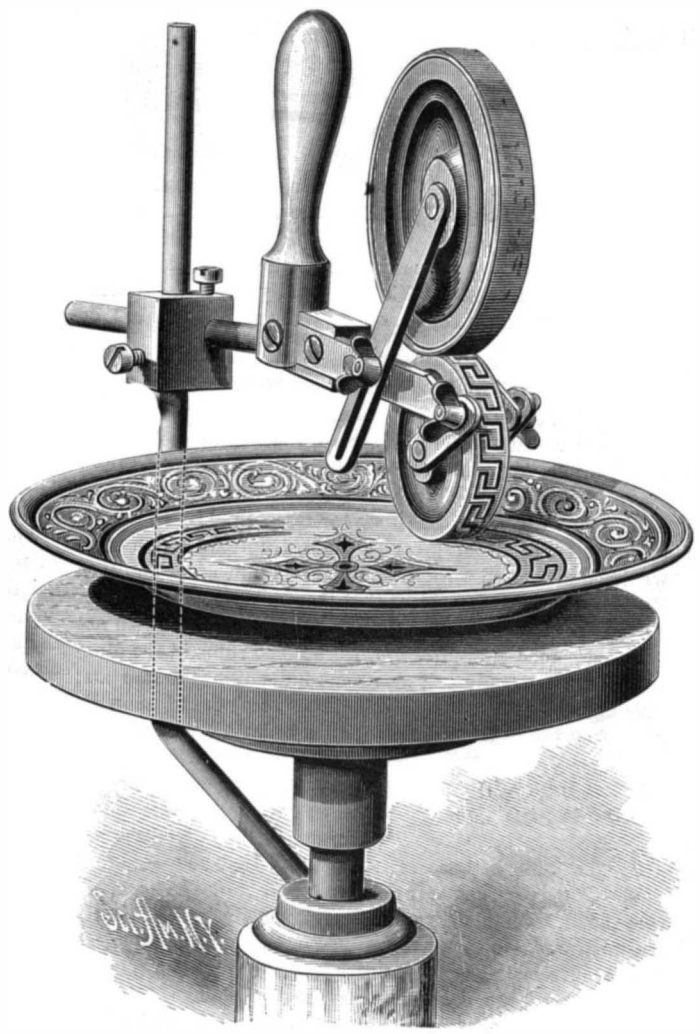
WITHERS' IMPROVED WAGON BRAKE.

APPARATUS FOR DECORATING POTTERY.

The decoration of china, until quite recently, has been done almost exclusively by hand, rendering it not only a slow but expensive operation. The engraving shows a simple machine, invented by Mr. S. J. Hoggson, of New Haven, Conn., for applying various styles of ornaments, but principally designed for borders.

The engraving shows the invention so clearly that a description is hardly necessary. The wheel which rolls upon the work to be ornamented carries the design and receives the color from the wheel above, and both wheels are sustained by a pivoted support provided with a handle, by which they may be raised or lowered or turned sidewise, as may be required to conform to various surfaces to be ornamented. The object to be ornamented is supported by a freely turning table, which is revolved as the impression roller is pressed upon the work. The inventor claims that there is no border or ornamentation, no matter how delicate or minute, ever came from the matrix of the type founder that cannot be produced upon china or any vitreous substance as perfect as if the impression had been taken by a master workman upon the finest paper, and with great rapidity.

The great advantage of this machine is in its applicability to plane, concave, convex, or any other surface, creeping over it as gently as a spider would, yet leaving its web-like tracings in enamel, which, when fired into the glaze of the ware in the usual manner, will last forever. It will work from ordinary type, electrotype, stereotype, wood-cut, or phototype patterns. The advantage of this over the transfer system used in old countries, on the cheaper kinds of ware, will be readily seen, and when we consider that, heretofore, all such decorations done in the United States were applications of the brush, in the same manner as an artist would paint a picture, we can begin to realize to what extent this little machine can be used.



APPARATUS FOR DECORATING ENAMELED SURFACES.

Progress of the Telephone.

Lowell, Mass., is connected by telephone with over one hundred cities and towns in the States of Massachusetts, New Hampshire, and Rhode Island. The longest circuit is from Springfield, Mass., *via* Worcester, Fitchburg, Lowell, Lawrence, to Exeter, N. H., over 150 miles, which is worked successfully. The telephone business between Boston and Lowell, a distance of 26 miles, amounts to $3,000 annually. The Lowell District Telephone Company, which owns and operates the systems of Worcester, Lowell, and Fitchburg, and the lines of the Northern Massachusetts Telephone Company use 2,500 telephones, and pay the American Bell Company a monthly royalty of over $1,200.

The company controls over 1,500 miles of wire, and employs in all divisions about twenty-five ladies and seventy-five men and boys.

MISCELLANEOUS INVENTIONS.

Mrs. Frank J. Kellogg, of Flint, Mich., has patented an apparatus for draughting patterns, by which the waists of ladies' dresses may be cut from measurement accurately and conveniently. It is a combined rule and square made in the form of a triangle, by which the form of the pattern may be laid out, a curved scale being used in connection with the rule and square for obtaining the proper shapes for the neck and arm-holes.

Mr. John C. Banks, of Vincennes, Ind., has patented an iron railing and fence, more particularly relating to the tubular post and rail variety of iron railing. The rails are polygonal tubes, each composed of two longitudinally flanged parts, the flanges of one part overlapping those of the other part. The posts are analogously formed, and the parts are connected by solder.

Mr. James C. Bowen, of North Springfield, Vt., has patented an improved refrigerator for supplying cars with cold air. The refrigerator is stationary, consisting of an ice box having a valved opening near the top, with a pipe leading from such opening to connect the refrigerator with an opening in the top of the car, and a second pipe leading from another valved opening in the refrigerator to a pipe or flue in the car which delivers the cooled air at the bottom of the cars. By these means the cooled air is made to circulate several times through the car and among its contents before disconnecting the source of cold, and the contents are more thoroughly and uniformly cooled than heretofore.

Messrs. Egesippe D. Melançon and John H. Ayrand, Sr., of Paincourtville, La., have patented an improvement in plows, by which an adjustment for cutting deeper or shallower furrows, and of the handles to adapt them to taller or shorter plowmen, is easily made by simple devices.

Mr. Edward A. Pearse, of Downend, near Bristol, county of Gloucester, England, has patented a machine for aerial navigation. The invention consists in improved means for suspending an aerial car from a gas bag, and in a set of adjustable legs for propping up one end of the car before rising, in order that the propeller may act in the direction of an ascending plane.

Joseph E. Culver, M.D., of Jersey City, N. J., has patented a steam generator intended to abstract more of the heat from the gases of combustion and prevent loss of heat by waste from the smokestack. A very novel and interesting arrangement and construction of parts is employed. The gaseous products of combustion and the steam may be used either separately or mixed for motive purposes. In the latter case the mixture is accomplished in a mixing pipe, into which both the steam and the gases are introduced through separate entrances.

Mr. Charles R. Nelson, of Corinna, Me., has patented a sheet-metal notching machine, which makes both square and bevel notches, at the same time clipping the lower corners of the plates preparatory to seaming and wiring the same. A flat bed plate is supported on suitable standards, having secured upon it a fixed and an adjustable cutting jaw and adjustable guide plates. A rocking shaft is journaled in the standards parallel with the bed plate, having keyed upon it a stationary and an adjustable dog, each of which carries a cutting jaw corresponding and operating with the stationary jaws of the bed plate.

Mr. Thomas H. Davies, of Fairview, N. Y., has patented a harrow which consists of two or more series of longitudinal zigzag bars, connected together at their angles by short cross bars, the several series of bars so connected being hinged together. The zigzag bars carry sockets for the teeth, and each series has an eye at each, by which means the draught may be applied at either end of the harrow.

Mr. C. Gordon Buchanan, of Brooklyn, N. Y., has patented an improved stone breaker of that class having two movable jaws. One of the jaws is pivoted at the top and the other at the bottom. The jaws are connected at the top by rigid links, and at the bottom by tension rods or tie bolts in such manner that almost all the tensile strain due to crushing is imposed upon the links and rods, thus obviating the necessity of casting the frame in one piece and of great weight and strength as heretofore. By pivoting the two jaws so that the motion of one is from the top and the motion of the other is from the bottom, a uniform crushing motion may be obtained from the top to the bottom of the crushing plates, if desired, and the throw of the jaws may be made shorter, saving power and securing more uniform crushing.

Mr. John P. Allen, of Dawson, Ga., has patented a seed planter and guano distributer, which will distribute cotton seed, corn, pease, and other seeds and grain, as well as guano, and other fine fertilizers, in drills, uniformly and in greater or less quantity, as may be desired, and which is simple in construction, strong, durable, and inexpensive in manufacture.

Mr. John W. McCorkle, of Freeport, Washington Territory, has patented an improved tuyere, which delivers either a single straight blast or a number of blasts radially inward toward the center. A sort of triple channel is formed in an annular casting, in such manner that two of these castings fitted together inclose one straight passage and two semicircular ones, each of which is controlled by a valve. From the two semicircular passages radial passages direct the flow of air toward the center.

Mr. Edward M. Richardson, of Laconia, N. H., has invented a car coupling so constructed that it is unnecessary for an attendant to enter between the cars for coupling or uncoupling. The coupler has a longitudinal perforation and side slots, a bar, sliding in the perforation, a crossbar attached to the sliding bar and working in the cross slots, pivoted horizontal bars, pivoted triangular lever plates, pivoted upright bars, a cross bar carrying the coupling pin, and a push bar placed in the rear part of the longitudinal perforation. The cars couple automatically and are uncoupled by moving the sliding bar forward.

Mr. Robert Cartwright, of Rochester, N. Y., has patented a head rest which can readily be attached to the back of a chair or other seat, and which can be raised or lowered, or adjusted forward or backward, as circumstances may require.

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WEAVER BIRDS.

Among the most important families of the finches are the true weaver birds, all of which inhabit the hotter portions of the Old World, the greater number of them being found in Africa, and the remainder in various parts of India.

The ribbon bird or collared finch has been long known as an inhabitant of West Africa, but its extent of territory is not confined to the western part, but reaches as far as the eastern coast. In the Nile regions it is met with from the sixteenth degree north latitude to the gloomy forests of the steppes. It avoids the real desert, and is seldom found in the primeval forests, as these forests do not afford the grasses rich in seed from which it obtains its food. It is not known whether it eats fruit. In captivity it takes readily to fruit and similar food, but lives principally upon grain and especially grass seed.

In North Africa these birds are commonly met with in communities of from ten to forty individuals, and are often united in large flocks with others of their species. This flock approaches the huts of the villagers fearlessly. In the morning hours they may be seen diligently employed in searching for their food, never running around upon ground, but climbing upon the low grasses. If the flock is disturbed the birds rise, fly to the neighboring trees, adjust their plumage, and the males begin to sing. As soon as the disturbance is over they all return to the ground. If a bird of prey approaches, the flock flies close together as swift as an arrow to some thick bush or tree, which affords them the necessary protection. In the middle of the day they sit quietly half asleep in the branches of a shady tree.

The male is distinguished from the female by a more beautiful coloring and a broad, magnificent carmine red collar, which extends from one eye to the other over the white throat. The eyes are dark brown, the bill and feet pale brown. The main color of the female is a pale brown, the back being darker and the under side lighter; every feather is edged with black. The wing coverts have a large grayish spot at the end, which is quite conspicuous. The bill is very strong, scarcely longer than it is broad and high, flattened at the top, the under part being very broad. The wings are of medium length, and the tail short and rounded. The whole length of this pretty bird is five inches, the wings two and one-half inches, and the tail one and one-half inches.

The nest of this bird is not known. The breeding time in Eastern Africa at least is in September and October, which period may be compared with our last spring months.

In captivity these birds collect the building material offered them into a more or less orderly nest. The females lay from six to nine white eggs, and the male alternates with the female in setting upon the eggs. The eggs mature in thirteen days.

In West Africa they are furnished by the natives in great numbers to bird dealers. They endure transportation well and require but little care.

The paradise whidah bird (*Vidua paradisea*) is often found in cages and menageries, as it is quite common in its native land, and bears confinement better than most tropical birds. It is an inhabitant of Western and Central Africa. It is a very graceful bird, perpetually in motion, and evidently admires its beautiful tail. Although not very brilliant in hue the paradise whidah bird is beautifully clothed with softly tinted plumage. The general color of the male bird is black, the wings dark brown, edged with pale brown. Round the neck runs a collar of rich ruddy brown, which edges the black line down the breast. The iris is dark brown and the foot brown. The female is the color of a sparrow, with two black stripes on the crown of the head, and black wings; on the breast it is a rusty red. The wings are edged with rust color. The length of the bird, with the exception of the long tail feathers is six inches; the length of the wings a little more than three inches.

The tail of this bird is very singularly formed. Both webs of the two central feathers are extremely broad for about three inches, and then suddenly disappear, leaving the bare slender shaft to project for two or three inches; the two next feathers are equally elongated and rather broadly webbed, being nearly three-quarters of an inch in width. They are often more than eleven inches long, and sweep in a graceful curve from the insertion of their quills to the extremity of their points. The beautiful tail feathers fall out after the breeding season, and the bird exhibits the sincerest grief for his loss, appearing to be thoroughly ashamed of his undress. Of its habits in a wild state but little is known.

The blood finch (*Lagonosticla minima*) inhabits all of Central Africa from the eastern to the western coast, and from twenty-two degrees north latitude to twenty-five degrees south latitude. Hartmann gives it a place similar to the one our house sparrow has gained, and, in fact, it may be considered as a house bird. At certain times this bird may be found in all of the villages of Southern Nubia and Eastern Soudan, even in the isolated huts standing in the midst of the forest. It is one of the first tropical birds noticed when traveling from Egypt to Soudan. Usually they are seen in the neighborhood of villages in large flocks, but they live also at a distance from men in the lonesome steppes, and even in the mountains at an altitude of 1,500 meters above the level of the sea, although they are rarely found there.

They are very active, and are excelled by few of their species in the rapidity of their flight. At midday they seek protection from the oppressive heat of the sun in the shady foliage of the evergreen trees.

They finish moulting in the last months of the dry season, and the breeding season begins with the first spring rains, somewhere in the beginning of September. Until then they live in flocks, but now separate in pairs and go into the cities and villages and look about for a suitable place for their nests under the roofs of the thatched houses and the clay huts of the natives. Here in some cavity or upon some suitable foundation they build a tangled nest of dry stalks, whose inside is well rounded. Their nests contain from three to seven white round smooth-shelled eggs. It is said that they breed more than once in the year; and this is in accordance with the knowledge we have of imprisoned birds of this kind. The male is very tender in his behavior to the female, and quarrelsome in presence of a rival. The male and female alternate in setting upon the eggs. The eggs are matured in thirteen days, and the young are fed with insects and softened seeds of various kinds.

The color of the blood finch is a purple wine red, fawn colored upon the crown and shoulders, every feather being edged with purple. The side of the breast is marked with small white spots. The under tail feathers are a pale brown. The female is nearly all fawn color, purple appearing on the back and neck, and the breast is spotted with white. The eyes are a deep brown, the bill red, the feet reddish. Their length 3½ inches; length of wings, 1¾ inches; and length of tail, 1½ inches. The blood finch is not only a bird of beautiful plumage, but is also an agreeable pet.

The fire weaver, fire finch, or orange bird, is distinguished chiefly by its plumage, which, in the breeding season, is peculiarly soft and velvety, and, with the exception of the wings and tail feathers, is black and vivid red. The other characteristics are a short conical bill, whose edges are slightly curved toward the point, feet provided with strong claws, the wings reaching down to the middle of the tail, the first quill feathers being very small and short, while the four following ones are nearly equal, and a short slightly rounded tail.

Aside from the breeding season the male and female wear a modest sparrow colored garment. Towards the breeding season the plumage of the male changes completely, not only in respect to the coloring, but also in respect to the quality of the feathers. Only the wing and tail feathers retain their usual character. At this time the male bird is of a velvety black upon the upper part of the head and breast, dark brown upon the wings with pale brown marking, the other parts being a brilliant scarlet. The new tail feathers grow to such a length as to nearly conceal the old ones. The pupil of the eye is brown, the bill black, the feet yellowish brown. The female is the color of a sparrow upon the upper side, a yellowish brown underneath, the throat being lighter. There is a yellow stripe over the eye; the bill and feet are the color of horn. The length of this bird is nearly 5 inches; length of the wings, 2½ inches; and of the tail, little more than 1½ inches.

The fire finch inhabits the durra fields in regions abounding in water from Central Nubia to the depths of inner Africa. It prefers cultivated regions under all circumstances to uncultivated. A durra field is its paradise, from which it can only be driven away with difficulty. Its habits are more like those of the reed bird than like the other weaver birds. Like them it climbs dexterously up and down upon the grass-like stalks, slides upon the rush grass to the ground, and when in danger, like the reed bird, conceals itself among the thickest of the stalks. After the fields which have given it shelter during the breeding season are harvested, this bird, with others of its species, makes raids about the country. The fire finch is notable for its sociability. Although the males are excited to sing at the same time they seldom come into contest. There exists among them the most harmless kind of rivalry, and they appear to enjoy each other's society. Their nests are skillfully woven together, but are built more simply than those of the other weaver birds. They are held up by the grass stalks but not suspended from them, and are partially, sometimes wholly, concealed by the high tufts of grass between the stalks of the durra. In form and size they differ from each other; some are round and some elongated. Upon an average their length is from seven to eight inches. The walls are lattice-like, and so loosely joined together that the beautiful blue eggs may be seen through them. There are from three to six eggs in a nest. Often from ten to twelve of these nests are found near together. It is thought that the female alone sets upon the eggs, but it can not be asserted with certainty. The young fly before the durra is harvested, and after the birds have left their nests they collect themselves into large flocks and become a plague to the country. In order to protect their grain the poor Nubians are obliged to keep a constant watch over their crops during the whole day.

The fire finch may be found in our bird market, but is

1. RIBBON BIRD.—2. PARADISE WHIDAH BIRD, FEMALE.—3. MALE.—4. BLOOD FINCH.—5. FIRE FINCH.

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often passed by by those not familiar with it, because it has on its beautiful plumage only a few months in the year. In cages it is kept upon the customary food, and with proper care will breed in them.—*Translated from Brehm's Animal Life.*

BOTANICAL NOTES.

The Number of Existing Species of Plants.—Dr. Müller, of Geneva, has recently made the following calculation as to the total number of existing botanical species: We have at present, described in our books, about 130,000 species; and, if we suppose that, in round numbers, 30,000 belong to countries like Europe and North America, where there are hardly any species, excepting some cryptogamic ones, to be discovered, the remainder, or 100,000, representing exotic plants, more or less tropical and southern, we may double the latter for new species, giving 200,000 for these less known regions, and altogether 230,000 for the whole globe, with the exception of countries still quite unknown botanically. Adding only 20,000 species for the latter, we reach a minimum sum of 250,000 species of plants.

The Effect of Freezing on Plants.—When frost attacks plants to such an conten that ice is formed in their tissues, says the *Gardener Chronicle*, it has been observed that the ice does not occur within the bags or cells of which the plant is made up, but outside or between them. The reason of this is probably because the contents of the cells are thicker and denser, and do not freeze so readily as do the thinner and more watery juices in the spaces between the cells. In this manner the essential part of the cell—so far as its life actions are concerned—the thick protoplasm, is less liable to injury. Moreover, as a consequence of the low temperature, the watery part of the cell-contents exudes from the interior through the cell-walls and there freezes. The expansion which takes place when water freezes, therefore, does not, at least in slight cases, take place within the cell, where it would do mischief by bursting the cell-walls, but outside them, where there is more room to expand and less risk of tearing the tissues. When the frost is more severe the tissues do become torn, cracks and fissures occur, the protoplasm is killed, branches fall, leaves wither or rot, and death ensues. But where the injury is less, and especially where the protoplasm is uninjured, when the thaw comes the ice outside the cells becomes melted, and the water, by the power of diffusion, passes once more through the cell-wall into its cavity, there to mix again with the more dense protoplasm. It is clear, then, that the danger to plants from frost is proportionate to the water they contain. If they are in an unripe, sappy condition the danger is far greater than if they are comparatively dry and at rest. Tubers and seeds, for instance, are specially adapted to resist cold; and how well they do so has been shown in the case of wheat which germinated at home after having remained throughout the winter in the Arctic regions.

The Power of Movement in Plants.—Mr. Darwin, in his recent work under the above title, now shows, after a prolonged course of experiment and observation, that "all the parts or organs in every plant, while they continue to grow, are continually circumnutating"—that is, the point of a growing stem, etc., is found to describe an irregular circular figure. This movement is not uniform, but consists, in some cases at least, of innumerable small oscillations. The phenomena thus produced closely resemble many of the actions performed, as is supposed unconsciously, by the simpler and lower animals. The author tells us that even among allied plants one may be highly sensitive to the slightest continued pressure, and another highly sensitive to a slight momentary touch. The author considers that the most striking resemblance between plants and animals is the localization of their sensitiveness and the transmission of any influence from the part excited to some other part, which consequently moves. It is not, of course, contended that plants possess a brain or other true nervous center, and a system of nerves by which it is connected with the whole body. But it is, to say the least, doubtful whether such structures exist in the lowest animals, and it is probable that where present they serve merely for a more perfect transmission of impressions and a more complete intercommunication of the several parts. Mr. Darwin calls attention to the wonderful character of the tip of the radicle, which is remarkably sensitive. If, says he, the tip be lightly pressed, or burnt, or cut, it transmits an influence to the upper adjoining part of the root, causing it to bend away from the affected side; and, what is yet more surprising, the tip can distinguish between a slightly harder and a softer object, by which it is simultaneously pressed on opposite sides. If, however, the radicle is pressed by a similar object a little above the tip, the pressed part does not transmit any influence to the more distant parts above, but bends abruptly toward the object. If the tip perceives the air to be moister on one side than on the other, it likewise transmits an influence to the upper adjoining part, which bends toward the source of moisture. Taking these various kinds of sensitiveness into consideration, Mr. Darwin pronounces it hardly an exaggeration to say that the tip of the radicle thus endowed, and having the power of directing the movements of the adjoining parts, acts like the brain of one of the lower animals, where the brain, seated within the anterior end of the body, receives impressions from the sense-organs and directs the several movements.

The Mexican Ocotilla.—The curious genus *Fouquiera* includes three described species, to which the Mexicans give the name "ocotilla." Although associated in the same natural order with the well known *Tamarix* by botanists, their relationship would scarcely be guessed from their aspect, especially as they have long, showy tubular corollas. Rev. E. Lee Greene, in a narrative of a botanizing tour in the Colorado desert, published in the *American Naturalist*, describes *Fouquiera splendens* as follows: "Extremely odd-looking, and not more odd than beautiful, is the small tree locally known by its Mexican name, ocotilla. It grows to the height of from 8 to 12 feet, and in outline is quite precisely fan-shaped. To show how this may be, let me more particularly describe its mode of growth. The proper trunk, usually 10 or 12 inches in diameter, is not more than 1½ feet high. At just a few inches above the surface of the sand this trunk abruptly separates into a dozen or more distinct and almost branchless stems. These simple stems, rising to a height of 8 or 10 feet, gradually diverge from one another, giving to the whole shrub the outline of a spread fan. Each separate stem is clothed throughout with short gray thorns and small dark-green leaves, and terminates in a spike, a foot long, of bright scarlet trumpet-shaped flowers. This splendid oddity flourishes in great abundance in many places. The stems are not so thickly armed with thorns but that a man may handle them if he will seize them circumspectly with his fingers, and being very hard and durable, as well as of a convenient size, they are much employed for fencing purposes about the stage stations and upon the ranches adjoining the desert. Give a skillful Mexican ocotilla poles and plenty of raw-hide thongs, and he requires neither nail nor hammer to construct a line of fence which, for combined strength, neatness, and durability, fairly rivals the best work of that kind done in our land of saw-mills and nail factories. As a tree or shrub of strange beauty the cultivators will vainly desire to add this to their list of varieties, unless their art can reproduce the parched and sterile gravel heaps, and the dry withering atmosphere which it finds congenial."

The Compass Plant.

The last number of Curtis's *Botanical Magazine* contains the following interesting account, by Sir J. D. Hooker, of the compass plant (*Silphium laciniatum*) of the Western prairies:

This noble plant was introduced (from America) into Europe in 1781 by M. Thouin, and flowered for the first time in the Botanic Garden of Upsala, in Sweden. It has been in cultivation in Europe ever since, though its name and fame as the compass plant of the prairies are of comparatively modern date, it having before that borne the popular names of turpentine plant and rosin weed, except among the hunters and settlers in the Western States. With regard to the history of its reputed properties as an indicator of the meridian by the position of its leaves, I am fortunate in having recourse to my friend, Professor Asa Gray, now in England, who has most kindly furnished me with the following very interesting account of this matter:

"The first announcement of the tendency of the leaves of the compass plant to direct their edges to the north and south was made by General (then Lieutenant) Alvord, of the U.S. Army, in the year 1842, and again in 1844, in communications to the American Association for the Advancement of Science. But the fact appears to have been long familiar to the hunters who traversed the prairies in which this plant abounds. The account was somewhat discredited at the time, by the observation that the plants cultivated at the Botanic Garden at Cambridge, U. S., did not distinctly exhibit this tendency. But repeated observation upon the prairies, with measurements by the compass of the directions assumed by hundreds of leaves, especially of the radical ones, have shown that, as to prevalent position, the popular belief has a certain foundation in fact. The lines in "Evangeline" (familiar to many readers, and beginning—

'Look at this delicate plant that lifts its head from the meadow,
See how its leaves are turned north as true as the magnet,' etc.)

were inspired by a personal communication made by General Alvord to the poet Longfellow. Since the leaves tend to assume a position in which the two faces are about equally illuminated by the sun, it might be suspected that their anatomical structure was conformed to this position. This has been confirmed, first by Mr. Edward Burgess, who, when a pupil of mine, observed that the stomata were about equally abundant on the two faces of the leaf; and next by Mr. Arthur, of Iowa, who has recently published in Prof. Bessey's 'Introduction to Botany' a figure of a section of a leaf showing that the arrangement of the 'palisade cells' of the upper and lower strata is nearly the same. The leaves always maintain a vertical position, except when overborne by their weight. As to their orientation, not only is this rather vague in the cultivated plant, but subject to one singular anomaly, which may be commended to Mr. Darwin's attention. I have several times met with a leaf abruptly and permanently twisted to a right angle in the middle; so that, while the lobes of the basal half pointed, say, east and west, those of the apical half pointed north and south."

To the above (says Dr. Hooker) I have little to add. I have not been able to detect any orientation of the leaves in the Kew cultivated specimens, but these not being planted in a good exposure all round, are out of count as witnesses. On the other hand, when traversing the prairies with Dr. Gray, in 1877, I watched the leaves of many hundred plants from the window of the railway car, and after some time persuaded myself that the younger, more erect leaves especially, had their faces parallel approximately to the meridian line. I may mention that I, on the same occasion, convinced myself that the flower heads of various of the great helianthoid compositæ that grew in hosts on the prairie did follow the sun's motion in the heavens to a very appreciable degree—their morning and evening positions being reversed. This observation did not, however, extend to the compass plant, the rigid stout peduncles of whose flower heads would not be expected to favor such a motion.

Fool's Parsley Not Poisonous.

For several centuries the common umbelliferous weed known under the common name of "fool's parsley," and botanically as *Æthusa cynopium*, has been an object of suspicion and classed by botanists and toxicologists among poisons. But now Dr. John Harley, of England, comes forward and presents a vindication of this plant, which he calls harmless and innocent. In the St. Thomas's Hospital reports he relates several facts to corroborate the truth of his assertions. Having collected the plants at two seasons of the year, just before flowering and also after the plants had set their fruit, he expressed the juices of both stem, leaves, and roots, and preserved the extracts by the addition of alcohol. Being thus provided with a supply of material which supposably represented the active principles of the plant, he exhausted his supply upon four persons, one a little girl six years old, who took the extracts in quantities ranging from two drachms to two ounces; himself, who took them in quantities ranging from two to four ounces; and two other adults, who were the subjects of spasmodic torticollis. These two took one or other of the juices, ranging from one to eight fluid ounces. Effects were carefully looked for, but none followed after any one of the doses.

Dr. Harley feels compelled to say, in conclusion, that the "fool's parsley" of Sussex, Essex, Kent, Surrey, and Hertfordshire, is not only absolutely free from the noxious properties ascribed to it, but that it is pleasant to the taste, sight, and smell, and, in the absence of the more fragrant and succulent herbs, might well be used as a pot-herb or salad. Moreover, he asserts that his conclusions are independent both of locality and season, the only influence that these conditions have on "fool's parsley," as on "hemlock" (*Conium*), being that of increasing or diminishing its succulency. Some years ago, Dr. Harley, after similar experiments, came to the same conclusion in regard to the alleged poisonous properties of hemlock (*Conium maculatum*). This weed, although for all ages it has been esteemed extremely poisonous, is nevertheless eaten as a pot-herb by northern natives—especially Russians—although the precaution is always taken to boil it in several waters.

The poisonous properties found in many plants, however, are quite volatile, and are readily dissipated by certain manipulations—especially by cooking. Those who have read Linnæus' "Flora Lapponica" must be familiar with the author's anecdote of the old Northland woman whom he saw picking the leaves of the aconite (*Aconitum napellus*). Asking her what she was going to do with them, she answered she was going to use them as food. He, thinking she had mistaken the plant for some species of geranium, warned her against its very poisonous nature; but she, smiling, assured him that she knew what she was about! He followed her to her dwelling, saw her boil the aconite leaves into a broth, and then, to his intense horror, observed the family of four persons sit down and partake of the terrible compound. But the great botanist is compelled to admit that not one of the persons seemed a bit the worse for their strange meal.

NEW INVENTIONS.

Mr. John T. Todd, of Chrisman, Ill., has patented an automatic car coupling, which consists of a concave-faced draw-bar, provided with interior upper and lower spring-actuated hooked jaws, and suitable levers for opening them. The coupling link has beveled ends, and shoulders or dogs for engaging the jaws.

A beehive, patented by Mr. David C. Cripe, of North Manchester, Ind., is so constructed that the bees are compelled to build their combs straight and of a uniform size. The comb frames are substantially supported, and there is no exposed metal within the hive to attract moisture and frost. The hive is inexpensive to construct and convenient in use.

A corset steel fastening, patented by Isador Ulman, of Santa Cruz, Cal., consists of a pair of steels, one of which is provided with a series of transverse plates, having a catch on one end and an eye on the other end, while the other steel is provided with corresponding transverse plates, having a tongue on one end to engage in the opposite catch, and an eye on the opposite end.

Mr. John N. Brown, of New London, Conn., has patented a seat pocket for vehicles, the invention consisting in a metallic frame peculiarly constructed and arranged, and designed as a substitute for the pockets usually made of enameled cloth heretofore used.

Mr. Charles McQueed, of New York city, has patented a neck ruching pressing machine, whereby the work of pressing collars, collarets, or neck ruching, is rendered more accurate and effective, and performed with a great saving of time and labor, as compared with ordinary methods.

Mr. William E. Stanton, of Ridgeville, Ohio, has patented an improved lawn mower, to which an initial movement can be given that enables it to work with the same power when starting as after it is fully in motion.

A refrigerating apparatus, patented by Mr. Kennard Knott, of London, England, comprises an air-tight or nearly air-tight non-conducting preserving chamber, and maintains a constant current of cooled, dried, and purified air through said chamber, for which, however, heated air may be substituted for certain purposes.

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MECHANICAL INVENTIONS.

Mr Newton P. Merchant, of Blaine, Mich., has patented an improved stump-puller, so constructed that it can readily be adjusted to operate with a quicker movement and less power for pulling small stumps and snags, or a slower movement and greater power for pulling larger stumps. The invention relates to that class of stump-pullers having inclined posts connected at their upper ends, a suspended frame for supporting the operating mechanism, and wheels and a pivoted shoe to adapt the puller to be readily moved from place to place.

Mr. Dolphus Torrey, of New York City, has patented an improvement in bells, which consists in a bell swaged from a composite plate made by inclosing steel in a box-pile having iron top and bottom plates, and sides made by bending a narrow plate of iron so that its ends overlap each other, heating the pile so formed, and subjecting it to hammering or rolling to produce a plate having a steel center and iron surfaces thoroughly welded together. It is claimed that such plates are harder, stronger, and more sonorous than iron plates, and possess better welding qualities than steel plates; and that out of them may be made bells lighter, stronger, and more durable than those of cast metal.

An improvement in traction engines, patented by Mr. Samuel S. Barr, of Waukon, Iowa, provides better means for guiding and controlling the movements of such engines than has hitherto been supplied. To the centrally pivoted front axle is attached, on each side of the center, the ends of a rope, which is coiled tightly around a rod journaled in boxes attached to the under side of the vehicles. A cog wheel is attached to one end of this rod, and is actuated by suitable gearing. Turning the bar winds off the rope at one end of the coil, and on at the other, thus inclining the axle in accordance with the turning of the wheel.

Mr. James H. Gressom, of Erin, Wis., has patented an improved wagon coupling, by which the front axle and sand-board are not weakened by the mortise commonly made for the wagon-reach, and by the usual nine bolt holes for the three bolts which ordinarily hold together the axle, sand-board, and front bolster. Other objections are also overcome by his improvement, in which he employs a coupling block transversely mortised on the under side to fit over and upon the sand-board and front axle, to which latter it is held by a single fore-and-aft bolt, and having a circular socket in its top for the reception of the circular base of the bolster support, held therein by a cover and provided with a rearward forked lug that clamps the forward end of the wagon reach.

Mr. James J. Kean, of San Francisco, Cal., has patented a spark arrester for locomotives, etc., which consists in a revolving turret, closed at the top, and formed with sides of perforated material, and a receiving chamber for the sparks; also in a conical and perforated sleeve, which is fitted within the turret, for assisting in breaking up the sparks, and a movable scraper for cleaning the inside of the turret.

Mr. Agustin Blasco y Fabregas, of Manila, Philippine Islands, has patented an improvement in vehicle wheels. The felly, or rim, and the hub combine great strength and elasticity, and any of the spokes may be removed without necessitating the removal of others or of the tire or rim. The felly is composed of laminæ of wood fastened together by screws; and on the metal tire which confines it are placed strips of leather which constitute a layer of elastic material. These strips of leather are separated at the ends, and on them are laid segmental steel plates, which form the peripheral portion of the wheel and sustain the wear. The hub is formed of the tapered butts of the spokes with lateral metal rings and tie-bolts.

Mr. Frank B. Galloway, of Farm Bridge, Ill., has patented a car-mover for starting and moving railway cars by hand. It consists of a lever provided with a hook at one end for the engagement of the car axle, and a spring pawl which engages the perimeter of the wheel. Devices for adjusting the instrument to different sized wheels and for varying the purchase are supplied.

A car coupling attachment, patented by Mr. Thomas C. Steward, of Chattanooga, Tenn., permits coupling of cars by the common link and drawhead without requiring the operator to enter between the cars. An adjustable bar or lever is employed to manipulate the link and guide it into the drawhead.

Mr. Henry Kenney, of New York city, has patented a machine for bending iron bars, for use in railroad work and where angular braces or stays are required, which is simple in construction and both convenient and powerful in operation. A bed-block with inclined arms, a top-block with inclined perforated and countersunk arms, with an arrangement of bolts, nuts, spiral springs, and a pivoted crosshead having a lever whereby the machine can be adjusted to bend different sized bars, are the principal features of the invention.

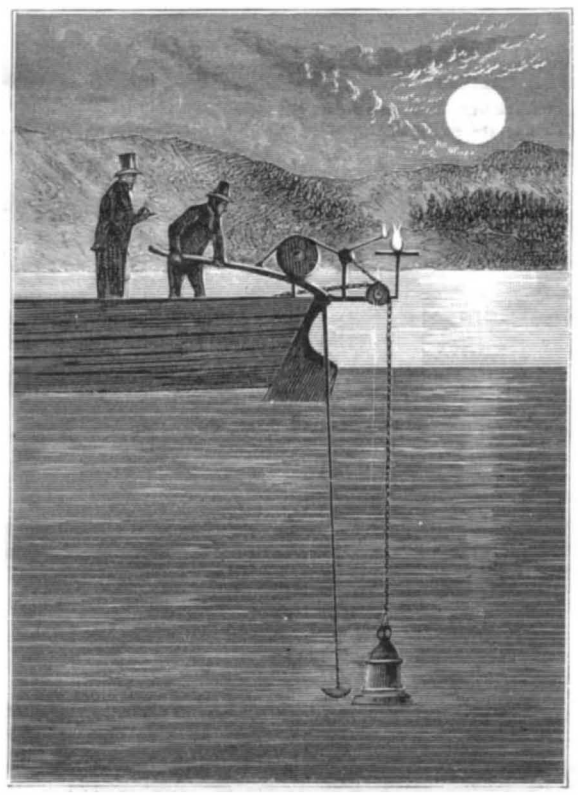
Mr. William Shortlo, of Springfield, Ill., has patented a fish-plate joint which consists in the combination of an inner plate having screw-threaded bolt holes, an outer plate having inner and outer longitudinal keyways, bolts having their shanks flattened on one side, and keys to fit in the keyways and bear against the shanks and heads of the bolts to prevent them from turning.

Mr. Lockhart Bibb, of Madison Station, Ala., has patented an automatic car coupling. The coupling link is provided with dogs or hooks at its ends, and is also longitudinally slotted for the reception of a safety pin which holds the cars coupled should either of the dogs break. The dogs on the link are engaged by spring-actuated drop catches to automatically couple the cars when the draw heads are brought together. The drop catches are raised by chains or other suitable device when uncoupling the cars.

Mr. Teodor Remus, of Dresden, Germany, has patented a pocket light which consists of a tubular case provided with a cylindrical cover with a roughened outer surface, which case contains a small candle or taper and a piece of tape covered with inflammable matter so arranged that when the cover is drawn off from the case the taper is ignited. The device is simple in construction, safe, convenient, and reliable.

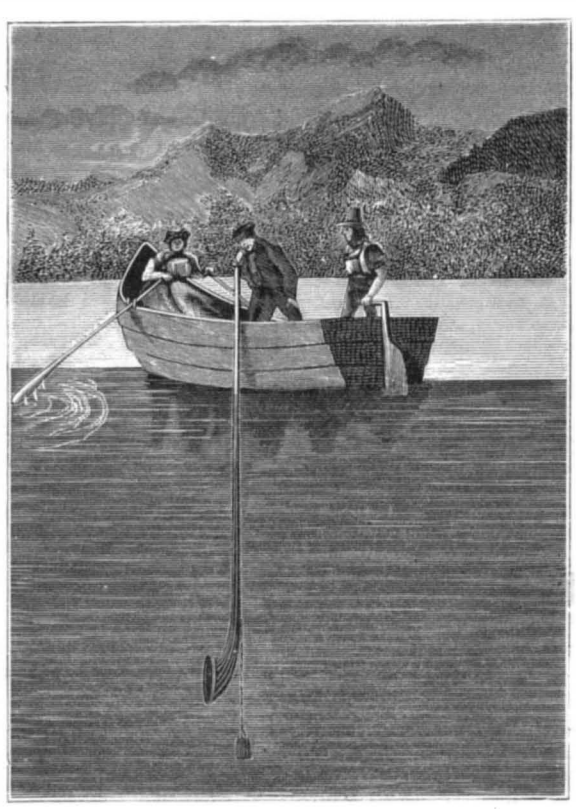
EXPERIMENT ON THE LAKE OF GENEVA TO ASCERTAIN THE VELOCITY OF SOUND IN WATER.

The velocity of sound in water has been the subject of patient investigation. Observers were placed in two



SOUND PRODUCING.

boats, which were moored at a certain distance apart on the Lake of Geneva. One boat was furnished with an apparatus, by which a submerged bell was struck, at the same instant that a charge of gunpowder was ignited in the air above it. In the other boat an ear trumpet was used to detect the arrival of the sound through the water, the lapse of time between the noise and the flash being noted by a chronometer. By this means it was ascertained that sound travels in water at the rate of 4,708 feet per second, being about four times



SOUND RECEIVING.

more quickly than in air. It must be understood that the velocity of sound in water, as in air, is subject to variation by temperature; the higher the temperature the greater the velocity.

PRESERVATION OF THE COLORS OF DRIED PLANTS.—According to M. Storbzl the slow immersion of the fresh plant in a boiling solution of one part of salicylic acid in six hundred parts of alcohol, and then shaking off superfluous moisture, previous to pressing in the usual way between blotting paper, will more nearly preserve the natural color than any other method.

GEOLOGICAL SURVEY OF NEW JERSEY.

We are in receipt of the Annual Report of the State Geologist (Prof. Geo. H. Cook) of New Jersey for the year 1879, setting forth the progress of the geological survey of the State. The survey being charged with work of an economic and practical character, the reports are necessarily largely confined to results related to this work. Joined to this there is, however, some work of a scientific character, and every year something is added to geological science.

The practical topics discussed in the report pertain to the iron mines of the State, soils, drainage, water supply, artesian or driven wells, economic geology of the State, topographical map of northeastern New Jersey, and the U. S. geodetic survey of the State.

Considerable space is devoted to the discussion of artesian or driven wells, of which there appears to be a large number, some of which supply water of a fair quality for economic purposes. In general, however, there is a large percentage of mineral matters held in solution. The deeper wells appear to afford water of a less satisfactory character than the shallower ones. Sulphates of lime, soda, and magnesia abound in nearly all the water drawn from deep wells in the State, and render it unfit for use in steam boilers or other apparatus in which scale is liable to accumulate. The water is of great use, however, for cooling purposes in breweries, etc., and for washing and rinsing where neither heat nor soap is required.

The question of water supply is of very great importance to New Jersey. It is difficult, if not impossible, in many localities to obtain water sufficiently pure for drinking and domestic purposes, except by the collection of rain water in cisterns. Especially is this the case in thickly settled regions near the seaboard. While these regions were sparsely inhabited the surface water, easily obtained by shallow excavations, could be used with comparative safety; but there is now so much danger of contamination from surface drainage that the use of such water is attended with great risk.

The report is an able and interesting document.

Hot Ice and Critical Pressure.

Prof. Carnelley's paper upon the effect of pressure on melting points which was published in the SCIENTIFIC AMERICAN of Oct. 23, 1880, continues to attract considerable attention at home and abroad. The fact that boiling points are influenced much more by pressure than are melting points has long been known. An increase of a single atmosphere (760 mm.) will raise the boiling point of water, for example, from 100° C. to 121·4°, equal to an increase of 39° Fah., while sulphur, which melts ordinarily at 111·5°, will melt at 133·2° under a pressure of 520 atmospheres, an increase of less than half a degree for each atmosphere of pressure. Since the temperature at which a substance boils can be depressed by simply diminishing the pressure upon its surface, it was but reasonable to expect that we could attain such conditions as would place the boiling point of a given substance below its melting point. In that case sublimation would precede and of course prevent fusion. Under the ordinary pressure the boiling point of metallic arsenic is lower than its melting point, so that it is only possible to melt it under increased pressure, which pressure is Carnelley's critical pressure. In the same manner ice has a boiling point lower than its melting point, provided the pressure be reduced to 4·6 mm. of mercury. It does not, therefore, appear probable that the actual temperature of the ice in his experiment, was higher than 32° Fah., for it is well known that when a body has been heated to its boiling point all the heat subsequently imparted to it is converted into work and rendered latent by converting said body into a gas. Neither can we heat any substance above its boiling point until it has been entirely vaporized. Ice boils at 32° under a pressure of 4·6 mm., and no amount of heat can raise its temperature above 32° under this pressure.

Carnelley tells us that for corrosive sublimate the critical pressure is 420 mm. Haass, therefore, proposes, in a communication to the German Chemical Society at Berlin, to use the corrosive sublimate for an instructive lecture experiment to illustrate "critical pressure." Take a strong glass tube, says he, sealed at one end, and place in it a piece of this substance, then connect the other end with a common filter pump provided with a manometer. As soon as the mercury has fallen to 420 mm. the corrosive sublimate may be heated as strongly as it is possible to do with a gas burner, and yet the salt does not melt, but sublimes into the colder part of the tube. If a little air is admitted so that the pressure is increased to 450 mm. it begins to melt. The experiment will prove an interesting one for the lecture table.

The phenomenon is easily explained. Corrosive sublimate melts at 265° C., and boils, under ordinary pressure (760 mm.), at 295° C. We notice here a very slight difference between the boiling and melting point, hence we ought not to be surprised to find that a comparatively slight reduction of pressure, less than half an atmosphere, would bring its boiling point below its melting point.

The critical pressure of Carnelley signifies, when translated into familiar language, the pressure at which the melting and boiling points of a substance coincide or pass each other. Probably, in the exhaustive paper on boiling points which he promises to publish soon, Carnelley will take the same ground as above laid down, and admit that his hot ice was not heated above 32° Fah.

E. J. H.

Atlanta, Ga., Jan. 15, 1881.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion, about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sale.—Valuable HayFork Patent. Simple, cheap, and efficient. J. M Boyd, Oak Center, Wis.

If you have a cold or cough, you can cure it by using Van Beil's "Rye and Rock."

See "Abbe" Bolt Forging Machine notice, page 140.

For Thrashing Machines, Engines, and Horse Powers, see illus. adv. of G. Westinghouse & Co., page 125.

Parties interested in the manufacture of delicious Cider, and desirous of obtaining the largest results from their apple crop, will study their own interest by writing to Messrs. Boomer & Boschert, No. 15 Park Row, for illustrated circular with prices.

Buy the Buffalo Port. Forge. Have no other.

Putnam Engine, 13 x 36; Corliss Engine, 8 x 24. Bullard, 14 Dey St., New York.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and metallic novelties a specialty. See advertisement on page 92.

The Inventors' Institute, Cooper Union, New York. Sales of patent rights negotiated and inventions exhibited and advertised for subscribers. Send for circular.

A large manufacturing concern desires to enter into correspondence with reliable houses doing business in sinking artesian wells. Please address Drawer 81, New Haven, Conn.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, successor to Bliss & Williams, Brooklyn, N. Y.

Hartshorn's Self-Acting Shade Rollers, 486 Broadway, New York. No cords or balances. Do not get out of order. A great convenience. Sold everywhere by the trade. See that you get Hartshorn's rollers. Makers and dealers in infringing rollers held strictly responsible.

Street Sweeper, Smith's patent, for sale. Machinery Exchange. 261 N. 3d street, Philadelphia.

Second hand large size Wood Planer, R. Ball & Co. make, for sale cheap, by Wm.M. Hawes, Fall River, Mass.

Wm. Sellers & Co., Steam Hammers. See ad., p. 108.

The Practical Papermaker; a complete guide to the manufacture of Paper, by James Dunbar. $1.00. Mail free. E. & F. N. Spon, 446 Broome street, New York.

Wanted—An experienced and thoroughly capable machinist, competent to design, build, and set up in working order light, special machines in a manufacturing business; also to superintend repairs in shop connected with the factory; must furnish best reference as to character, habits, and ability. Address P. O. Box 539, Baltimore, Md.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 92.

Abbe Bolt Forging Machines and Palmer Power Hammer a specialty. S. C. Forsaith & Co., Manchester, N. H.

L. Martin & Co., manufacturers of Lampblack and Pulp Mortar-black, 226 Walnut St., Philadelphia, Pa.

Large Slotter, 72″ x 18″ stroke. Photo on application. Machinery Exchange, 261 N. 3d St., Phila.

List 25.—Descriptive of over 2,000 new and second-hand machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N. H.

Books for Engineers and Mechanics. Catalogues free. E. & F. N. Spon, 446 Broome St., New York.

4 to 40 H P. Steam Engines. See adv. p. 93.

Send to John D. Leveridge, 3 Cortlandt St., New York, for illustrated catalogue, mailed free, of all kinds of Scroll Saws and Supplies, Electric Lighters, Tyson's Steam Engines, Telephones, Novelties, etc.

Pure Oak Lea Belting. C. W. Arny & Son, Manufacturers. Philadelphia. Correspondence solicited.

Eclipse Portable Engine. See illustrated adv., p. 93.

Within the last ten years greater improvements have been made in mowing machines than any other agricultural implement. It is universally acknowledged that the Eureka Mower Co., of Towanda, Pa., are making the best mower now in use, and every farmer should write to the manufacturers for catalogue, with prices.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 108.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

For Machinists' Tools, see Whitcomb's adv., page 73.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N. Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Wren's Patent Grate Bar. See adv. page 109.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Saunders' Pipe Cutting Threading Mach. See p. 109.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Peck's Patent Drop Press. See adv., page 109.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Blake "Lion and Eagle" Imp'd Crusher. See p. 109.

Silent Injector, Blower, and Exhauster. See adv. p. 124.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

The American Electric Co., Proprietors and Manufacturers of the Thomas Houston System of Electric Lighting of the Arc Style. See illus. adv., page 125.

See Bentel, Margedant & Co.'s adv., page 125.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa,

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 126.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 126.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

Blake's Belt Studs. The strongest fastening for leather and rubber belts. Greene, Tweed & Co., N. Y.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 125.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 125.

Best Band Saw Blades. See last week's adv., p. 125.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke & Son, 40 Cortlandt St., N. Y.

Linen Hose and Rubber Hose suited for all purposes. Greene, Tweed & Co., 118 Chambers St., New York.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 125.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 124.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 124.

Use Vacuum Oil Co.'s Lubricating Oil, Rochester, N. Y.

Lightning Screw Plates and Labor-saving Tools, p. 125.

Hotchkiss' Mechanical Boiler Cleaner, 84 John St., N. Y., has imitators; meritorious inventions do; beware of them, they are all infringements. Engineers make ten per cent selling other parties than employers.

Clark Rubber Wheels adv. See page 109.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) R. L. W. asks: How much water evaporated from 212° is a horse power? Some say 21 lb., others 27 lb., 30 lb., and some as high as 36 lb; if there is a rule, I would like to know it. A. It depends upon the perfection of the machine or engine through which the steam is used. 21 lb. per horse power would be deemed an excellent result. It is a very good engine that uses less than 24 or 25 lb.; a very poor engine may not only use 36 lb., but even more

(2) J. B. V. inquires: Has there ever been so early a winter as the present? What is the cause of the polar waves or cold snaps? Can you send a record of the weather for the past fifty years? Can a person predetell what kind of a winter we will have? Can accurate predictions be made as to what kind of weather we will have a day, week, month, or year in advance? Have you published anything about the weather in the SCIENTIFIC AMERICAN or SUPPLEMENT? If so, please refer to the number A. There are certain things that are quite unknown to any one on the staff of the SCIENTIFIC AMERICAN, and the ability to give an "accurate prediction" of the weather daily, monthly, or a year in advance, is a fair type of those matters that transcend their powers. Our correspondent will have to propound his queries to some of those entities which are said to be hovering about in mid air, and who may thus be assumed to be cognizant of such matters, for to answer them is clearly beyond the province or powers of ordinary mortals.

(3) A. and E. ask: Can you tell us of a cement that will cement cloth or felt to iron? A. See marine glues, page 2510, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(4) G. F. H. asks: How can I drill a one-sixteenth inch hole through Arkansas stone? A. Use a very hard steel drill with slow speed, or a copper or soft iron drill with emery or diamond dust and higher velocity.

(5) R. F. M. asks: What is used for thinning printer's inks, both common and fine inks? A. Printer's varnish, or a thinner printer's ink. The varnish is prepared by inflaming boiling linseed oil and stirring it while it burns until a black "varnish" of the proper consistence is obtained. The flame is extinguished by placing a tightly fitting cover over the pot.

(6) F. L. B. asks: 1. Do the directions given in SCIENTIFIC AMERICAN, of January 25, 1881, No. 35, under Notes and Queries, make a similar pad to that advertised as the hektograph? A. Yes. 2. Would not a tin trough or plate answer as well as one of zinc? A. Nearly as well. 3. Will Cox's gelatine, such as can be bought at the grocers (used in cooking), do for the gelatine part? A. Yes. 4. When you say, "parts," do you mean by weight or bulk? A. Parts by weight.

(7) W. E. J. asks: 1. Are oscillating engines used now and for what? A. Yes, for many purposes. 2. Would there be any value in an engine with similar valves to an oscillating toy engine, but with stationary cylinder, thus saving the power required to move the latter? Would such an engine make a good motor? A. We think it would not be desirable for actual use.

(8) A. J. C. asks: Will wood 3 feet long in a stove a little over 3 feet high and 2 feet wide last longer than wood cut short enough to lay across the stove? A. In either case, its slow or rapid burning depends upon the manner it is laid. If the sticks are laid parallel and close, they will burn slowly; if laid partially crossing each other, so as to be open, they will burn rapidly.

(9) F. L. S. asks how much more power a steam engine would have if there was no dead center, or, in other words, with the full force of crank for full revolution. A. The difference would hardly be appreciable, using the same amount of steam.

(10) A. S. L. writes: We have a boiler and furnace connected with our establishment; is it cheaper to run both with pea coal, or to run the first with pea and the latter with furnace coal? A. It depends upon the prices of the different kinds of coal in your market; but as a rule the pea coal is most economical.

(11) C. J. H. writes: I have a quantity of granulated test lead carrying, say, one ounce silver to the ton. How shall I desilverize the lead and reduce to absolutely pure metallic lead? If reduced to a nitrate how shall I desilverize and manipulate the resultant salt after evaporation? A. For small quantities the following will answer. Dissolve in a small quantity of hot nitric acid diluted with half its volume of water and evaporate by heat nearly to dryness. Decompose with an excess of dilute sulphuric acid (acid 1, water 2). Let stand (in the dark) with the liquid several hours, then decant the latter (which contains the silver), wash the white lead sulphate with fresh dilute sulphuric acid, dry, heat to low redness then intimately mix with dry bicarbonate of soda and powdered charcoal in the proportion of 1 oz. lead sulphate, half an ounce bicarbonate of soda, and 40 grains of charcoal. Charge into a clay crucible, cover, and fire at a bright red for fifteen minutes. Pour, or cool and break. Assayers rarely desilverize their lead; it is preferable to determine accurately by assay the amount of silver present in a given quantity, and allow for this in calculating results.

(12) D. P. asks: 1. Can you tell me how the paint used in painting window curtains or shade cloth is made, mixed, and applied? A. Consult "The Painter's and Gilder's Companion." See addresses of book dealers in our advertising columns. 2. How can I perforate heavy paper for transferring designs? The perforations in postage stamps is what I want on manila paper. A. The perforations in postage stamps are effected by passing the sheets between two cylinders, one above the other, and provided with a series of raised bands which are adjusted to a distance apart equal to that required between the rows of perforations. Each ring on the upper cylinder has a series of cylindrical projections or punches which fit corresponding depressions in the bands of the lower cylinder; by these the perforations are punched out. An endless band separates the perforated sheet from the rolls. The sheets require pressing to remove the roughness caused by the perforating machine. The machine was invented and patented in 1852, by Mr. Archer, of England.

(13) A. B. asks (1) for a simple test by which to distinguish alkali water from pure water. A. Add to the water a small quantity of strong neutral tincture of litmus. If the water is alkaline the litmus will change in color to a deep purplish blue. 2. How is the quantity of alkali in a given quantity of water determined? A. The quantity of alkali in a water is most readily determined by titrating a measured sample with a standardized solution of acid. Consult Thorp's Chemical Analysis. 3. What is the best filter I can use to purify water that contains foreign matter, so as to make it suitable for raising steam? A. Consult our advertising columns for filters.

(14) E. H. L. asks (1) whether a lawn sprinkler would revolve if worked in a vacuum. A. Yes. 2. The query is, what produces the revolution? Is it the difference of pressure of the water on the inside and at the openings, or is it the resistance of the air to the small streams? A. It is the difference of pressure.

(15) A. Y. F. asks for the process by which the ribbons used in type writers, hand stamps, etc., are made and prepared. A. Saturate the ribbon with a strong solution of one of the soluble aniline dyes in hot glycerine.

(16) W. S. R. writes: I have a Wedgwood sirup cup that is cracked and leaks, although the crack is only visible on the inside. Can you give me a receipt for some varnish, or cement that can be used as a varnish, that will be insoluble in hot sirup or water, and stop the leak? A. See the thirtieth cement in the list, page 2510, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(17) J. L M. asks: Is meerschaum a manufactured article? Is it manufactured from sea foam? A. True meerschaum (*Ger., seafoam*) is a native mineral, a hydrous silicate of magnesia. Much of the so-called meerschaum in the market is manufactured—not from sea foam, but from waste chips and powder of meerschaum cemented together, or from a composition of magnesia, water, silicate of soda, sulphate of magnesia, etc.

(18) J. F. S. asks for some simple way of rendering horns soft and pliable (without destroying their original shape). Have tried steam at 80 lb. without any satisfactory result. A. Digest them in pure hydrochloric acid diluted with three volumes of water until softened.

(19) G. B. S. writes: I have a small saw-mill engine 10 inches by 20 inches, and the connecting rod is only 34 inches. I think it a very poor proportion. Give me a better one, and give dimensions the fly wheel should be, also the speed? A. A connecting rod in length 2½ times the stroke is considered a good proportion. According to the usual proportions your wheel should be about 6 feet 6 inches diameter and weigh 3,000 lb. If your engine is well balanced it may run from 130 to 160 revolutions per minute, or even faster if the work requires it.

(20) E. A. C. writes: In putting up the feed water pipe on one set of boilers, which of the two valves must be near to the boiler, the stop valve or the check valve? A. The stop valve should be placed next the boiler.

(21) J. D A. asks: What ingredient can be mixed in the manufacture of tinner's solder (half and half) which will be harmless to use and give a quick flow to the solder? Should such solder be moulded hot or cool? A. Try a small quantity of bismuth; mould cool.

(22) C. H. H. asks: 1. Do freight trains on N. Y. L. E. & W. R.R. haul broad and standard gauge cars indiscriminately on same train? A. Yes. 2. If so, how are draw bars arranged? A. Draw bars for passenger trains by special link and distance block, and for freight trains by three-link coupling. 3. Are some trains made up of broad and others of standard gauge cars? A. Yes; but all one gauge if possible. 4. Do they use broad gauge passenger coaches? A. Yes, on branches running through to Jersey City. 5. Is there a third rail whole length of road; if not, between what stations? A. Yes, on all the main line from Jersey City to Buffalo.

(23) H. J. C. asks: Will the thickness of a belt run over the same size pulleys make any difference in speed, other things being equal? A. No, if there is no slip of belt.

(24) W. S. wants to know how much a one and one-eighth inch ship cable chain will sustain and what size hook it will take. A. Ultimate strength 19·7 tons to 21·5 tons; proof test 15·2 tons to 15·75. Should not be worked regularly over one-fourth the ultimate strength. Opening of link for hook or pin 1½ inch.

(25) H. S. asks: 1. Would a half-inch board hold up a piece of earth 10 feet thick? A. It would depend entirely on the area of the board. 2. What sized battery (Bunsen's) would be required to light a room 10 feet high, 15 feet long, and 12 feet wide? A. 20 to 25 quart Bunsen cells.

(26) P. writes: SCIENTIFIC AMERICAN, February 12, 1881, page 106, Notes and Queries, No. 19, "Should be thicker than if vulcanized" ought to read *galvanized*. There is no such thing as vulcanized iron. [Clearly a mistake of the typo. Our correspondent is also mistaken—it should have been *ungalvanized*.]

(27) C. P. T. asks: 1. Does the pitch of a propelling screw increase or decrease its resistance to the motive power? A. Increased pitch requires more power, and decreased less. 2. Does a sharp pitch propel at a greater speed than a less pitch? A. It propels at a greater speed, if you have the power to drive it at the same velocity as the wheel with less pitch. 3. Supposing I had sufficient power, so that the question of necessary power was not considered, what pitch would give the greatest speed? A. There is no fixed pitch, for it depends upon many conditions, and each case must be determined by its own conditions. 4. Would a shaft 20 feet in length, upon which were four pairs of wings, 5 feet apart, give more propelling power than a single pair—that is, supposing the wings or screws to be all of the same pitch and diameter? A. We think not.

(28) W. R. H. writes: With a 10x24 engine running 100 revolutions, steam ports 1¼x4 inch, exhaust 2¼x4 inch, bridges seven-eighths inch, valve steam lap half an inch, exhaust lap one-quarter inch, what would be the right travel of valve, and are the steam ports too small for the speed of engine? A. Your openings are rather small. Valve should have 3 inch travel, 1½ inch each way. Reduce the exhaust lap to one-sixteenth inch scant

(29) G. R. asks: Does the strain on belt driving an emery wheel increase with an increase of speed? If so, in what ratio? A. Not appreciably, the amount of work done by the wheel remaining the same per revolution.

(30) D. E. T. asks: 1. What number of Callaud cells is required to work bell calls, ordinary single stroke, on a half mile line of No. 12 wire, one at each end? A. It will require five cells. 2. How is a relay constructed, and what purpose does it serve? A. A relay is much the same as a sounder. Its magnet is wound with finer wire, and its armature lever, which is very light, is made to open and close a local circuit. It is used in lines in which the current is too weak to work a sounder 3. In the transmitter described by Mr. Hopkins, in SCIENTIFIC AMERICAN of May 8, why could not the bottle be constructed with a cork in the top with small piece of glass tube for the carbon, and the platinum wire inserted at the side of the small tube and save the glass blowing, which seems to be the only part of any difficulty for amateurs with limited facilities to make? A. The experimental transmitters of this kind were made in the way you suggest. There is no objec-

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tion to the plan, provided the ends of the glass tube are fused to remove the sharp edge. By attaching a small platinum point (about the size of a pin's head) to the diaphragm instead of the carbon button the effectiveness of the instrument will be increased. 4. What size should the platinum wire be? A. It is immaterial; copper wire will answer just as well if used in the manner proposed by you.

(31) J. H. writes: 1. Our mechanic has made a dynamo machine as designed in SUPPLEMENT, No. 161, which did not work before it was connected with a battery, and after it was disconnected from the battery about an hour it began to work, and has done so ever since. Now, will a dynamo machine work without it being charged with a battery? A. Iron is usually more or less magnetic, and the slightest degree of magnetism in the iron of your field magnet would have been sufficient to start a current in the armature, which would have increased rapidly until the maximum current was reached. It seems that your field magnet must have been neutral. After having been charged by the battery it retained sufficient magnetism to start the current. It has been found that when the field magnet is neutral sufficient magnetism to start the machine may be imparted to it by placing it on the earth's magnetic meridian. 2. Can you give us a design of a dynamo machine which is strong enough to magnetize a piece of steel in the form of a norseshoe magnet which is 12 inches long, 1½ inch wide, and ½ inch thick? A. For this purpose you would need a large machine such as the Edison, Maxim, Brush, Weston, or Siemens, all of which have been described in our columns.

(32) J. P. E. writes: 1. In a late edition of your valuable paper you give directions for building an upright, single-acting rocking valve engine. Please tell me how I can get up a cheap, effective, steam supply for an engine on that principle, having 2 inch bore, and 2½ inch stroke. Would a copper boiler, 11 inches in diameter and 22 inches long, tested to stand 150 lb. to square inch, with 4 4-inch wicks burning good refined petroleum, be at all effective and efficient? A. Such a boiler should have 20 to 25 1-inch tubes. You would hardly get the full power of the boiler with the four wicks. 2. Would a grate burning fine coal be better than the oil supply? A. Yes, much better. 3. What should be bore and stroke for a pump for engine of given dimensions. A. A pump having a piston one-quarter inch in diameter and 1 inch stroke would be sufficient to supply the boiler. It would be well to make either the speed or stroke of the pump variable.

(33) P. S. writes: I would like to make an induction coil, but I think the one in SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, too large, and in the SCIENTIFIC AMERICAN, vol. xxxix., page 203, No. 14, too small. Would you please answer me the following questions. 1. Would a coil 4½ inches long on inside, by 2½ inches diameter, be too large to give shocks, using small battery power? A. It would not be too large, as you can regulate the strength of the current as may be required. 2. If not, please give diameter of core, weight, and number of primary and secondary wire? A. Diameter of core, five-eighths inch. Three layers of No. 18 silk covered wire for a primary, and 12 to 14 layers of No. 36 silk covered wire for the secondary. 3. Would a thin brass tube covering the wires of core, which draw out to regulate the current, keep the coil from working? A. It would modify the action somewhat, but it would not entirely prevent its working.

(34) F. S. P. asks (1) how the connections are made in a "Gramme electro-magnetic" machine. After having wound the soft iron ring armature with a number of lengths of insulated wire, how are the ends of these coils of wire connected to the copper strips upon the axis? A. The inside terminal of one coil is connected with the outside terminal of the next, and both together are connected with one of the copper strips, and so on throughout the entire series of coils and strips. 2. What position do these strips of copper have upon the axis as the coil passes from north to south pole of the magnet? A. The strips are parallel with the axis, and the collector brushes which press upon opposite sides of the commutator cylinder should be adjustable, so that they may be moved from the neutral point to the point where the maximum current is obtained.

(35) S. R. M. asks: Could a telegraph message be sent over a wire of any length, one end being well grounded in the earth, the other in a large water tank or lake of any size which was well insulated from the earth? A. No; a complete circuit is required.

(36) H. B. writes: Referring to an article in your paper some time since, "How far can cannonading be heard?" would say many of us (I among them) distinctly heard, two days (and think three) in succession, at Lynchburg, Va., while prisoners in the rebel lines, the sound of the guns of McClellan's battles on the Peninsula. It was clearly heard towards close of the afternoon, days bright and clear sky. It sounded like a bucket being dropped inverted in water. Whatever the distance is, there is no mistake about it.

(37) S. R. asks: What is the longest railway bridge in the world? A. It is said that the railway bridge over the estuary of the Solway, near Annan, is the longest in the world, being 1,940 yards in length. The next longest to it is that built for the Orenberg railway over the Volga near Syzrau, which is a few yards short of 1,624 yards.

(38) A. B. M. inquires: How is pyroligneous acid (wood vinegar) made? A. It is obtained by distilling wood in iron retorts, resembling those used for making illuminating gas. The condensed products of the distillation contain, with tar and numerous other bodies, crude pyroligneous acid or wood vinegar, amounting in a well conducted distillation to about 7 or 8 per cent of the wood employed. The gas that accompanies the liquefiable distillates is conducted to the furnace under the retort, and serves to continue the distillation without other fuel. In purifying the acid, it is first saturated with lime, evaporated to dryness, roasted at a moderate temperature so as to free it from volatile matters, and decomposed in a retort, having a helm of copper and a condenser of tin or silver, with hydrochloric acid (90 parts acid to 100 acetate of lime), and the acetic acid distilled.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

D. R. Y.—No. 1. Hornblende schist. No. 2. Red sandstone. No. 3. Dolerite. No. 4. Cherty flint.

COMMUNICATIONS RECEIVED.

On Parhelia. By U. F. G.

On a Simple Experiment with Polarized Light. By E. G. H

On a Singular Atmospheric Phenomenon. By H. B. C.

NEW BOOKS AND PUBLICATIONS.

THE LOGICAL-MATHEMATICAL DEVELOPMENT.

The logical-mathematical development of the causes of the principal phenomena of nature, such as gravity, elesticity, light, color, heat, electricity, chemical combinations, etc., from a single fundamental principle. By Theodor Wiesemann. Brussels· 1879. Paper, 63 pages.

THE PHOTOGRAPHIC TIMES.

The *Photographic Times*, which was formerly issued as an addendum to the Philadelphia *Photographer*, began the new year of 1881 as an independent publication, with an able editor—Mr. J. Trail Taylor, formerly of the British *Journal of Photography*. The January number of the *Photographic Times*, now before us, contains a large amount of matter of interest and value to practitioners of the art beautiful. $2 a year. Single copies 25 cents. Scovill Manufacturing Company, publishers, 419 Broome street, New York.

JOHNSTON'S ILLUSTRATIONS OF ELECTRICITY. SHEET 5. ELECTRO-DEPOSITION OF METALS. WITH HAND-BOOK. By Alexander Watt. Edinburgh and London: W. & A. K. Johnston. 10s. Size 50x 42 inches.

One of a series of charts in color for use in teaching natural philosophy. The illustrations of apparatus, etc., are large, so as to be readily seen by a class, and the several parts are colored as in the objects themselves. The sheet before us pictures twenty-three forms of voltaic battery, dynamo-electric machines and their elements, thermo-electric apparatus, and apparatus for electrotyping, electroplating, gilding, nickel plating, etc. The hand book briefly describes the objects figured and their uses. The charts would seem to be admirably adapted for use in schools unprovided with a physical laboratory; and if the price were reasonable, say fifty cents or less a sheet, they might find a wide acceptance among our common and private schools.

A TEXT BOOK OF ELEMENTARY MECHANICS FOR THE USE OF SCHOOLS AND COLLEGES. By Edward S. Dana. New York: John Wiley & Sons.

Though specially designed for use in schools this elementary treatise seems well adapted for individual study. Its scope is limited to the mechanics of solids. It would add much to the practical value of the mathematical courses in our schools if a treatise like this could take the place occupied by surveying, navigation, or mathematical astronomy.

SMITHSONIAN MISCELLANEOUS COLLECTIONS. JAMES SMITHSON AND HIS BEQUEST. By William J. Rhees. Washington: Published by the Smithsonian Institution.

This is the first authentic account of the man who has laid the United States and the world at large under such great obligation by his bequest to found the institution which bears his name. Though barred by law from claiming the family name and honors of his father, the Duke of Northumberland, Smithson sought a higher fame in the discovery and propagation of scientific truth. In one of his manuscripts was found this memorable prophecy following a reference to his relationship to England's noblest families: "My name shall live in the memory of man when the titles of the Northumberlands and the Percies are extinct and forgotten." The prophecy bids fair to come true.

AMERICAN SANITARY ENGINEERING. By Edward S. Philbrick, C.E. New York: The Sanitary Engineer. 8vo, cloth, pp. 129.

A dozen lectures covering in a peculiarly suggestive and practical manner the subjects of ventilation, house and town drainage, sewerage, and the like. The matter is presented in a way well calculated to command attention from home makers as well as house builders and sanitary engineers. The methods and appliances recommended have been chosen for their fitness to meet the conditions of our climate, our modes of life, and more obvious sanitary needs. The single marked defect of the book is the lack of an index.

DEBAUN'S PRACTICAL CALCULATOR, No. 1. New York: Bicknell & Comstock. Folio. 50 cents.

A multiplication table extended to 100x100; and very compactly arranged, so that one can readily find at a glance the product of any two numbers within the limit. Obviously it can be used as a division table with equal readiness, and with slight figuring extended to products and quotients of larger numbers.

CIRCULARS OF INFORMATION OF THE BUREAU OF EDUCATION. No. 4. RURAL SCHOOL ARCHITECTURE. No. 5. ENGLISH RURAL SCHOOLS. Washington: Government Printing Office. 1880.

The Bureau of Education is doing good service in preparing and distributing information of the kind given in these circulars. They should go not only to all school officers or communities intending to build schoolhouses, but to every school district in the land, for the instruction of school trustees, teachers, and parents. There is a vast amount of barbarism in and about our country school-houses which these circulars will help to mitigate.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 25, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air compressor, J. R. Cushier ... 236,992
Air engine, A. S. Lyman ... 236,954
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Wood borders, making, G. C. Setchell ... 237,054

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TRADE MARKS.

Cigars, cigarettes, cheroots, smoking and chewing tobacco, and snuff, L. Wertheimer ... 8,152

English Patents Issued to Americans.

From January 21 to January 25, 1881, inclusive.

Axle bearings, J. E. Maynadier, Boston, Mass.
Feed water heaters, J. H. Dane, San Francisco, Cal.
Ice machine, A. J. Rossi *et al.*, New York city.
India-rubber waste, restoration of, H. A. Clark, Boston, Mass.
Lawn mowers, Lloyd, Supplee & Walton, Phila., Pa.
Ore separator, J. F. Halbrook *et al.*, Palmer, Mass.
Vinegar, manuf. of, O. F. Boomer *et al.*, Brooklyn, N. Y.
Watches, F. C. Comstock, Indianapolis, Ind.

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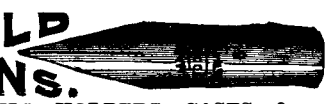

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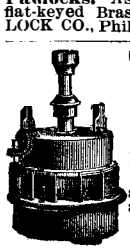

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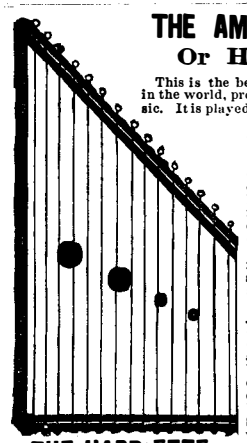

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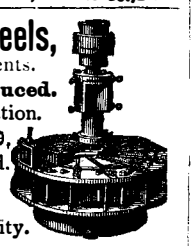

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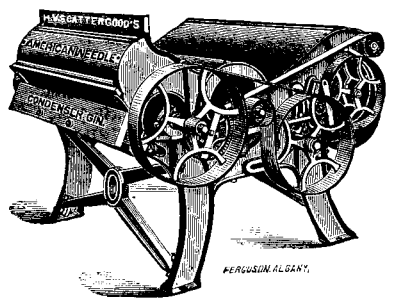

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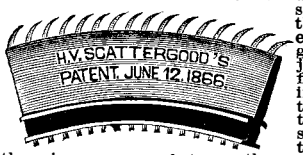

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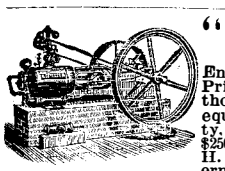

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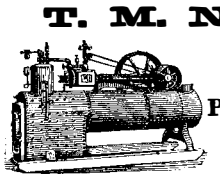

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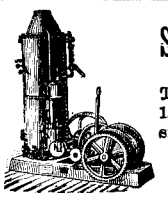

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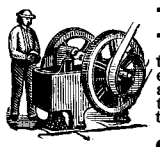

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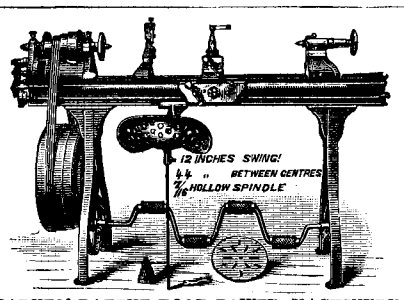

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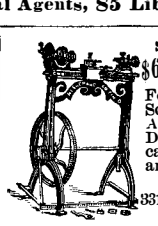

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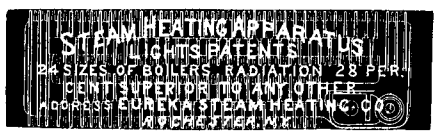
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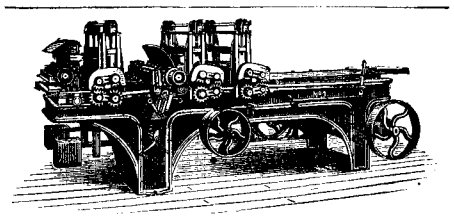

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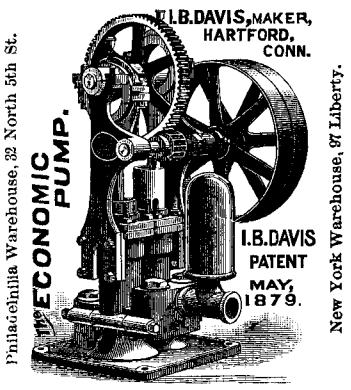

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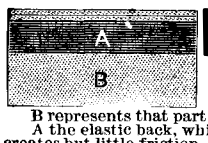

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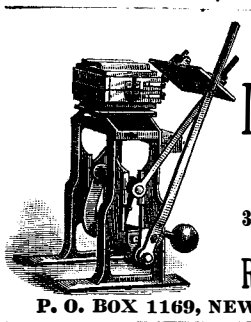

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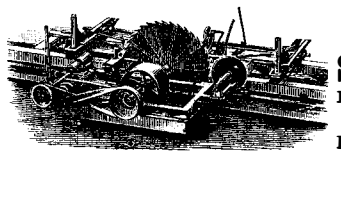

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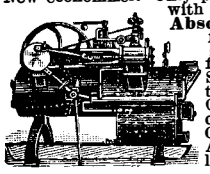

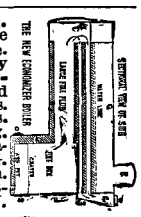

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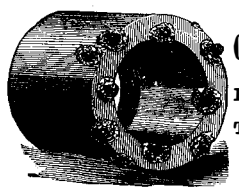

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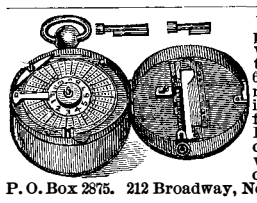

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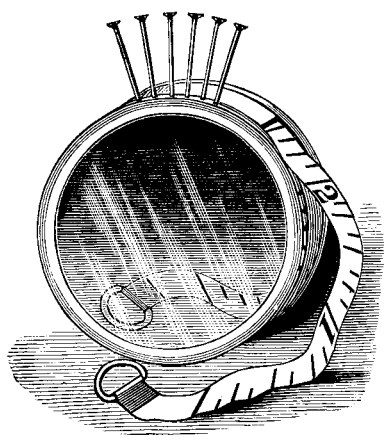

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